ME522A

Error Rate Measuring Equipment

Operation Manual

Second Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Measuring Instruments Division
Measurement Group

ANRITSU CORPORATION

OCT.
1995

Document No.: M-W0176AE-2.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.

Symbols used in manual

DANGER	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
WARNING	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.) The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

ME522A Error Rate Measuring Equipment
Operation Manual

June 1986 (First Edition)
October 1995 (Second Edition)

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Printed in japan

For Safety

WARNING

1. Always refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

For Safety

CAUTION

Changing Fuse

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. Always use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

   □□□A or F□□□ A indicate a normal fusing type fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

2. Keep the power supply and cooling fan free of dust.

   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Cleaning

3. Use two or more people to lift and move this equipment, or use a trolley. There is a risk of back injury, if this equipment is lifted by one person.

Check Terminal

4. Never input a signal of more than 20 V between the measured terminal and ground. Input of an excessive signal may damage the equipment.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to misoperation, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding and earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact the head office of Anritsu Corporation at the address in the operation manual, or your nearest sales or service office listed on the following pages.

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Note:

1. The instrument is operable on a nominal voltage of 100 to 127 Vac or 200 to 250 Vac by changing the connections on the power transformer taps.

   The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.

   To operate on the other voltage, change the connections on the power supply transformer. The plate on the rear panel indicating the voltage and current ratings should be changed to the appropriate one. Order the plate from ANRITSU CORP. if needed.

2. In this manual, the power supply voltage and current ratings are represented by **Vac and ***A, respectively.

3. The relationship between power supply voltage and current rating is shown below.

**Vac	***A
100 to 127 V	6.3 A (T6.3A 250 V)
200 to 250 V	3.15 A (T3.15A 250 V)

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SECTION 1

GENERAL

The ME522A is a multi-purpose error rate measuring equipment of 1 Mb/s to 1.4 Gb/s.

As a high-speed digital communications system, the ME522A is ideal for development, manufacturing, and installation of 565 Mb/s and 1.2 Gb/s optical fiber systems. Moreover, it is also useful for testing high-speed semi-conductors of GaAs FET and/or GaAs IC, and optical devices of LD, etc.

The ME522A is composed of two instruments: a transmitter and a receiver, both of which are covered in this operations manual.

The functions of the ME522A can be expanded through the use of plug-in units. Refer to the unit operation manuals for details on the plug-in units.

Plug-in Units:

- 565 Mb/s U/B, B/U converters
  MH5104A U/B Converter, ME5105A B/U Converter
- 1.4 Gb/s MUX, DMUX
  MH676A Multiplexer, MH677A Demultiplexer
- E/O, O/E converters
  MH945A E/O Converter, MH946A O/E Converter

SECTION 2

COMPOSITION AND SPECIFICATIONS

2.1 Composition

2.1.1 Standard composition

The standard composition of the ME522A Error Rate Measuring Equipment is shown in Table 2-1.

Table 2-1

	Item	Name	Qty.	Remarks
Transmitter	Instrument	Error Rate Measuring Equipment ME522A Transmitter	1	
	Accessories	Coaxial cables	2	BNC-P [ ] — RG58A/U 2 m — BNC-P [ ] 50 Ω
		GP-IB cable	1	2 m
		Power cord	1	
		Fuses	3 sets	1 set: T***A250V --- 2 MF51NN250V0.2ADC01 --- 1 MF51NN250V1.6ADC01 --- 2 MF51NN250V2ADC01 --- 2 MF51NN250V5ADC01 --- 2 MF51NN250V6.3ADC01 --- 2

Table 2-1 (Continued)

	Item	Name	Qty.	Remarks
Re-ceiver	Instrument	Error Rate Measuring Equipment ME522A Receiver	1	
	Accessories	Roll paper for printer	4	TP50K S-4F
		Power cord	1	
		Fuses	3 sets	1 set: T***A250V --- 2 MF51NN250V1ADC01 --- 3 MF51NN250V2ADC01 --- 1 MF51NN250V5ADC01 --- 3 MF51NN250V6.3ADC01 --- 1
Trans-mitter Re-ceiver	Accessories	Operation manual	1	

2.1.2 Options

ME522A Error Rate Measuring Equipment options are listed in Table 2-2.

Table 2-2 Options

Option No.	Name	Remarks
10	RS-232C interface	For transmitter
11	RS-232C interface	For receiver
70	GP-IB interface	For receiver

2.1.3 Plug-in units

The plug-in units for the ME522A Error Rate Measuring Equipment are shown in Table 2-3.

Table 2-3 Plug-in Units

Model	Name	Remarks
MH5104A	U/B converter	565 Mb/s
MH5105A	B/U converter	
MH676A	Multiplexer	1.4 Gb/s
MH677A	Demultiplexer	
MH945A	E/O converter	Optical interface
MH946A	O/E converter	

2.1.4 Optional accessories

The optional accessories for the ME522A Error Rate Measuring Equipment are shown in Table 2-4.

Table 2-4 Optional Accessories

Ordering No.	Name	Remarks
J0081	Coaxial cable (75 Ω), 2 m	For 75 Ω interface
J0133C	Coaxial cable (50 Ω), 2 m	For 50 Ω interface
J0133F	Coaxial cable (50 Ω), 0.4 m	For 50 Ω interface
J0008	GP-IB cable, 2 m	For GP-IB interface
J0019A	RS-232C cable, 2 m	For optional RS-232C interface
Z0031B	TP50KS-F roll paper	For thermal printer built into receiver
B0166 (Transmitter) B0167 (Receiver)	Carrying case A	For instrument transportation; it can store one transmitter or one receiver and includes two protective covers
B0169	Soft case	For instrument transportation; can store one transmitter or one receiver
B0021	Protective cover	For instrument transportation

2.1.5 Peripheral equipment

The peripheral equipment for the ME522A Error Rate Measuring Equipment is shown in Table 2-5.

Table 2-5 Peripheral Equipment

Name	Remarks
Personal Technical Computer Packet III	For control of automatic measurement system
Portable Test Rack MB24A	Fold-up type, maximum capacity: 100 kg

2.2 Specifications

2.2.1 Transmitter

Table 2-6 ME522A Transmitter Specifications

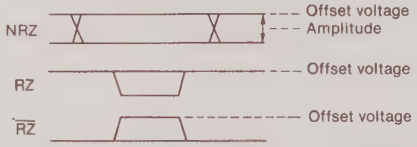
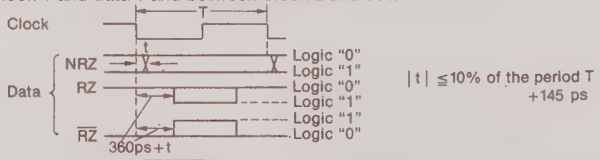
Clock	Internal	Frequency range : 1.000MHz to 700.000MHz in steps of 1kHz Accuracy : Within $\pm 2 \times 10^{-6}$. After 30 minutes operation Frequency memory : 9 frequencies
	External	Frequency range : 1MHz to 700MHz Input level : 0.8 to 1.2Vp-p Input waveform : 1MHz to 10MHz: Rectangular waves 10MHz to 700MHz: Sinusoidal or rectangular waves Impedance : 75Ω Connector : BNC
Patterns	Pseudo-random patterns (PRBS)	7 stages, 10 stages, 15 stages,* 23 stages* (*According to CCITT Rec. O.151)
	Programmable patterns	3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits. When the initial switch is set, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C automatically.
	Alternate patterns	8-bit programmable patterns D and E
	Isolated patterns	1/1 to 1/64 (1/m: one mark ("1") in a pattern of m bits)
	Logic inversion	Logic inversion is possible for all of the above patterns.
	Gate	Gating by external signal is possible for all of the above patterns.
Unipolar output	Operation frequency	1MHz to 700MHz
	Clock 1, data 1	Waveform : Clock: RZ* (*Duty: Within 45 to 55% with internal clock) Data: NRZ, RZ,* $\overline{RZ}$* Amplitude : 1 to 3V in steps of 0.05V (However, display is made in steps of 0.1V) Also, ECL. (ECL: when connected to −2V via 50Ω or 75Ω) Offset : −1 to +4V in steps of 0.05V. (However, display is made in steps of 0.1V) Also ECL. (ECL: when connected to −2V via 50Ω or 75Ω) Level accuracy : Voltage and offset within the larger one of set value ±10% or ±0.15V 
	Clock 2, data 2	Waveform : Clock: RZ (Duty: Within 45 to 55% with internal clock) Data: NRZ Level : Within 0/−1V ±0.1V
	Phase, logic	Clock 1 : Switching is possible between CLOCK and $\overline{CLOCK}$ Between data 1 and data 2: PRBS pattern: About 1/2 period Other patterns: Same phase Between clock 1 and data 1 and between clock 2 and data 2:  (For $\overline{CLOCK}$, the time "t" is expressed using a rising edge as the reference)
	Load	Switching between 50Ω and 75Ω is possible (But clock 1, 2 and data 1, 2, 3 are coupled)
	Connector	BNC
CMI output	Operation frequency	1MHz to 150MHz
	Number of outputs	4 (DATA 3 on the front panel, DATA 4 to 6 on the rear panel. Same phase.)
	Level	Within 1 ±0.1Vp-p
	Load	Data 3: Switching between 50Ω and 75Ω is possible Data 4 to 6: 75Ω
	Connector	BNC

Table 2-6 ME522A Transmitter Specifications (Continued)

Error insertion	Error	Bit error
	Internal	Ratio : 2×10^{-3}, 2×10^{-4}, 2×10^{-5}, 2×10^{-6}, 2×10^{-7}, single
	External input	Operation frequency : DC to 1/40 of the clock frequency Level : TTL Connector : BNC
Other input and output	Alternate signal input	Operation frequcny : DC to 5MHz Level, connector: : TTL (Low: Output of pattern D; High: Output of pattern E), BNC
	Gate signal input	Operation frequency : DC to 1/4 of the clock frequency Level, termination, connector: Within 0/−1V ±0.1V (0V: Signal through; −1V: Signal inhibit), 75Ω, BNC
	Clock sync output	Level, termination, connector: 0.3 to 1Vp-p (AC coupled), 50Ω, BNC
	Pattern sync output	Level, termination, connector: 0.3 to 1Vp-p (at 700MHz, AC coupled), 50Ω, BNC
Remote control	Interface control	GP-IB (Standard equipment, IEEE Std. 488-1978), RS-232C (Option)
	Control	Setting is possible for all switches except the power switch
Power		AC **V ±10%, (max. 250V), 50/60Hz, max. 280VA (when the unit is not installed), max. 330VA (when the unit is installed)
Dimensions and weight		222H, 426W, 450D mm; max. 28kg (when the unit is not installed), max. 33kg (when the unit is installed)
Ambient temperature, rated range of use		0 to 50°C

2.2.2 Receiver

Table 2-7 ME522A Receiver Specifications

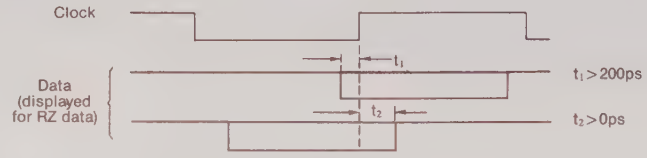
Unipolar input	Operation frequency	1MHz to 700MHz
	Clock, data	Waveform : Clock: RZ* (*Duty: Within 45 to 55%) Data: NRZ, RZ,*$\overline{RZ}$* Amplitude : 1 to 3V, ECL Offset : −1 to +4V, ECL Threshold voltage (data): −2.5 to +3.5V in steps of 0.05V. (However, display in steps of 0.1V) Threshold voltage $= \frac{V_1+V_2}{2}$ Phase adjustment (clock): Switching between CLOCK and $\overline{CLOCK}$ and adjustment for ±500ps in steps of 100ps are possible. Phase relation between clock and data: After the phase adjustment described above; For NRZ data: freely selectable For RZ or $\overline{RZ}$ data: limited as follows  (For $\overline{CLOCK}$, the time "t" is expressed using a falling edge as the reference) Termination : Connection via 50Ω or 75Ω (Switch selection, clock and data are coupled) to earth (other than ECL) or −2V (ECL) Connector : BNC
CMI input	Operation frequency	Within 139.264MHz ±14kHz
	Level	Within 1 ±0.1Vp-p
	Termination	50Ω or 75Ω (Switch selection)
	Connector	BNC
Patterns	Pseudo-random patterns (PRBS)	7 stages, 10 stages, 15 stages,*23 stages* (*According to CCITT Rec. O.151)
	Programmable patterns	3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits. With the initial switch setting, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C.
	Isolated patterns	1/1 to 1/64 (1/m: One mark ("1") in a pattern of m bits)
	Logic inversion	Logic inversion is possible for all of the above patterns.
Measurement-	Error detection and measurement	Bit errors (bit by bit comparison). All of the following measuring items are executed simultaneously. Display of the measuring values during measurement is possible (in intervals of 1 second).
	Measuring items and display range	Error rate : 0.0E−16 (0.0×10^{-16}) to 1.0E−0 (1) Number of errors : 0 to 99999 to 9.9E 16 (9.9×10^{16}) Error interval : Switching is possible between the intervals of 0.01 sec, 0.1 sec, and 1 sec. Switching is possible between synchronous mode and asynchronous mode 0 to 99999 to 9.9E 16 (9.9×10^{16}) Error free interval : 0.0000% to 100% Frequency : 1.000MHz to 700.000MHz. Error: Within ±(20ppm+1kHz) Voltage : 0.0 to 20.0V. Error: Within ±(2% +0.2V)
	Lamp indication	Power failure (lighting at the time of power supply recovery), signal loss,* pattern sync loss,* AIS,*error, gating (the lamps marked by *also are available with memory).
	Buzzer	Buzzing at the time of signal loss, pattern sync loss, AIS, and error. Buzzing can be switched ON and OFF.

Table 2-7 ME522A Receiver Specifications (Continued)

Measuring mode, real time clock	Measuring mode	Switching is possible between repeat, single, and untimed (manual).
	Measuring time	Time : 1 sec to 99 days, 23 hrs, 59 min, 59 sec in steps of 1 sec. Number of clock pulses: 10^7 to 10^{15} bits in steps of 1 digit Display : Display of the remaining measuring time and the elapsed time is possible. (Also possible when the measuring period is the number of clock pulses.)
	Real time clock	Year : Month : Day : Hour : Minute : Second Error : Within 4 sec. per day
Other input and output	Voltage input	0 to 20V or 0 to −20V
	Status input	Level, connector : TTL, BNC
	Alarm output	Normal: Open between 2 terminals. Abnromal (Power failure, signal loss, pattern sync loss, AIS): Short-circuit between 2 terminals. Terminal rating: DC 100V, 0.5A or less.
Printer	Printing method	Thermal
	Printing letter	Max. 20 characters/line
	Printing contents	Measured values (intermediate and final values), error occurrence, alarm status, threshold error interval, threshold error free interval, error performance data, time.
	Manual printing	Possible
Remote control	Interface	GP-IB (Standard equipment, IEEE Std. 488-1978), RS-232C (Option)
	Control	Setting is possible for all switches except the power switch. Transmission of measuring values is possible.
Power		AC **V ±10% (max. 250V), 50/60Hz, max. 200VA (when the unit is not installed); max. 250VA (when the unit is installed).
Dimensions and weight		222H, 426W, 450D mm; max. 22kg (when the unit is not installed); max. 27kg (when the unit is installed).
Ambient temperature, rated range of use		0 to 50°C

SECTION 3

OPERATION

3.1 Precautions

3.1.1 Operating and storage conditions

This instrument is designed to operate normally in an ambient temperature range of 0° to 50°C. For best operation, however, it should be used at normal room temperature whenever possible. Do not use or store the instrument in locations

1. where vibrations are severe.
2. where it is damp or dusty.
3. where there is exposure to direct sunlight.
4. where there is exposure to active gases.
5. where there is exposure to magnetism.
6. where oxidation or rusting may occur.

The instrument should be stored in a temperature range of 0° to 55°C, and a humidity range of 40% to 80%. It should be cleaned before storage. The storage area should not be subject to large fluctuations in temperature over a 24-hour period.

If this instrument is operated at room temperature after being used or stored for a long period at low temperatures, condensation may occur and cause short-circuiting. To prevent this do not turn the power on until the instrument is completely dry.

CAUTION

Make sure that the ME522A air inlet and air outlet do not get plugged. (A hole in the bottom front and a fan in the rear help pass out air.)

If the air in/out flow is insufficient, the temperature in the ME522A will rise, leading to a possible breakdown.

3.1.2 Power requirement

The ME522A operates normally at ** Vac ±10% (max. 250 V), 50/60 Hz. The transmitter power consumption is ≦280 VA (≦330 VA when equipped with a unit) and the receiver is ≦200 VA (≦250 VA when equipped with a unit).

WARNING

- To prevent possible shock, be sure to ground the ⏚ terminal on the rear panel.
- Before changing a fuse, be sure to turn off the power switch and disconnect the power cord from the ac outlet.

3.1.3 Termination and maximum input level

CAUTION

In a case where the ME522A output signal has been terminated by other than the specified method described in paragraph 2.2, the ME522A output circuit may be damaged.

If a signal exceeding the specified level described in paragraph 2.2 is applied to the ME522A signal input section, the ME522A input circuit may be damaged.

3.1.4 Connection of device to be measured

CAUTION

Before connecting the device to be measured and the ME522A, be sure to verify that the status of the ME522A input/output level setting is suitable for the input/output conditions of the device to be measured. In case the status is unsuitable, for example, the ME522A output level is set at too high a value, the device to be measured may be damaged.

3.1.5 Memory back-up

Even when the power is turned off, the ME522A memorizes the panel set status and measured data.

The ME522A uses rechargeable thionyl choloride lithium primary batteries for the memory back-up. This back-up functions for approx. 7 years. In case of battery wear or damage, contact ANRITSU or your nearest representative.

Normally a worn-out battery will not affect measurement. In this case, the panel setting, when the power is turned on, returns to the initial state (refer to paragraph 3.3.1), instead of the previous set status.

3.1.6 MH676A multiplexer/MH677A demultiplexer

When the MH676A is inserted in the ME522A transmitter and the MH676A [MUX OPERATION] key LED is turned on, the data output pattern of the ME522A transmitter, from DATA 1 to DATA 6, is different from the pattern set with the ME522A transmitter, although there is no malfunction. Also, the MH677A demultiplexer unit is inserted in the ME522A receiver and the MH677A [DEMUX OPERATION] key LED is turned on. At this time, the internal comparison pattern in the ME522A receiver is different from the pattern set with the ME522A receiver. However, there is nothing abnormal. These things only occur in cases where the programmable word pattern is used by the ME522A. For a description, refer to the MH676A multiplexer/MH677A demultiplexer operation manual.

3.1.7 Stacking the transmitter and receiver on top of each other

When the transmitter and receiver are to be stacked, by aligning the four feet of one with the four foot holders on the top of the other, both will be automatically locked. To release this lock, pull up the portion marked by arrows as indicated in Fig. 3-1.

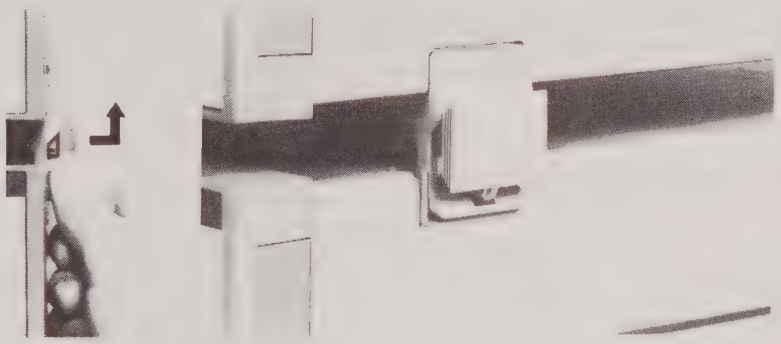


Fig. 3-1 Stacking the Transmitter and Receiver

3.1.8 Packaging

A protective cover and carrying case (A) (or soft case) is recommended.

3.2 Explanation of Controls

3.2.1 Transmitter

Table 3-1 Explanation of Controls (Transmitter Front Panel)

No.	Label	Function	Paragraph
#1	CLOCK	This function selects and sets clock signals.	3.4.1
	EXTERNAL INTERNAL VARIABLE	Generates the pattern that synchronizes with the external clock signal. Sets the internal clock signal. Setting clock signal frequency 1. Press the [SET] key. The LED for the digit that can be set starts blinking. 2. Move the blinking LED to the digit to be set by using the [<] [>] keys. 3. Set the frequency numeric values by using the [^] [v] keys. 4. After setting the frequency, press the [SET] key. The frequency is set when the numeric values are set.	
	INTERNAL MEMORY	Restores and reads frequencies that are often used. Storing clock signal frequency to memory 1. Press the [MEMORY] key. (Key LED comes on) 2. Set the F number to be stored by using the [^] key. The preset frequency is displayed. 3. Press the [SET] key. Set the frequency in the same way as VARIABLE.	
#2	PATTERN	This function selects patterns and sets programmable words.	3.4.1 (2)
	LOGIC PROGRAMMABLE WORD A,B,C	Switches the logic (1 or 0) for all patterns. Setting programmable patterns A, B, and C 1. Set N/ADDRESS to N. 2. Set word length N by using the [^] [v] keys. (The pattern length is N x 8 bits.) 3. Set N/ADDRESS to ADDRESS. Address 1 is displayed. 4. Press the [SET] key. (Key LED comes on) 5. Set BITs 1 to 8 to 1 or 0. LED on state is 1 and off state is 0. 6. To set BITs 1 to 8 to all zeros, press the [CLEAR] key. 7. After setting BITs 1 to 8, press the [SET] key. (Key LED goes off) 8. Subsequently set the pattern by changing the address in the same way. When the [SET] key LED is turned off, the output pattern is set.	
	ALT D/E	For the N/ADDRESS display, only ADDRESS is left.	
	1/N	For the N/ADDRESS display, only N is left.	

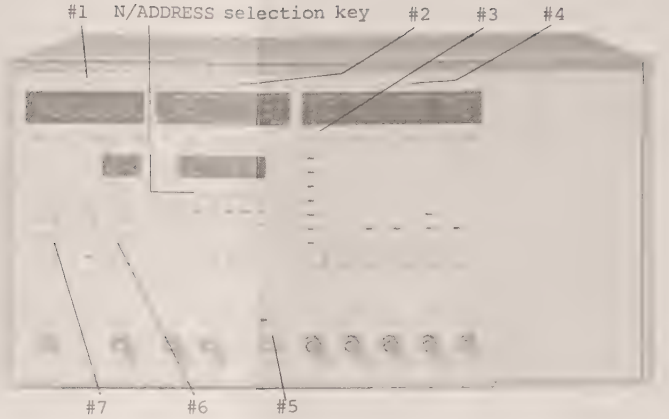
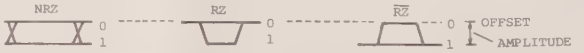


Fig. 3-2 Transmitter Front Panel

Table 3-1 Explanation of Controls (Transmitter Front Panel) (Continued)

No.	Label	Function	Paragraph
#3	ERROR ADDITION	Adds dummy errors to DATA output 1 to 6.	3.4.1 (3)
#4	OUTPUT	This function sets the output levels and waveforms of CLOCK 1 and DATA 1.	3.4.1 (4) (5)
	CLOCK 1, DATA 1	Sets the amplitude and offset of CLOCK 1 and DATA 1.	
	PORARITY LEVEL (clock, data)	Switches the polarity of the clock signals. ECL: When the CLOCK 1/DATA 1 output is connected to -2 V through a 50 Ω or 75 Ω load, the output level is set to the ECL level. VARIABLE: Optionally sets the output amplitude and offset.	
	FORMAT	Switches the waveform of DATA 1. 	
#5	LOAD	Switches the output impedance (75 Ω/50 Ω) according to the impedance of the measuring system. Both CLOCK outputs 1 and 2 and DATA outputs 1, 2, and 3 are switched simultaneously.	
#6	CONTROL	When the transmitter is controlled externally by the GP-IB or RS-232C interface, the REMOTE LED is on. The REMOTE LED is off when the LOCAL mode is selected.	
#7	PANEL LOCK	When this key is pressed, only the POWER switch can be operated.	

3.2.2 Receiver

Table 3-13 Explanation of Controls (Receiver Front Panel)

No.	Label	Function	Paragraph
#1	PATTERN	Setting is made according to the transmission pattern. For details on how to set the pattern, see #2 in Table 1-1.	
#2	MEASUREMENT	This function displays measured results and sets measurement conditions.	3.4.2 (4)
	DISPLAY	The entire measurement is performed simultaneously. Only the item selected by the key is displayed.	
	ERROR RATE ERROR COUNT ERROR INTERVAL ERROR FREE INTERVAL FREQUENCY Voltage	Displays the average error rate Displays the number of error pulses Displays the number of error intervals Displays the ratio of error free intervals Displays the frequency of the clock input signal Displays the voltage added to the VOLTAGE terminals (#10 on the rear panel).	
	1 SEC 0.1 SEC 0.01 SEC	Sets the interval for error interval measurement. The interval is always set to 1 second when the ERROR PERFORMANCE switch on the rear panel is set to on.	
	MEAS MODE	REPEAR: Measurement is performed repeatedly. SINGLE: Measurement is performed only once. UNTIMED: Measurement is performed from the time when the [START] key is pressed to the time when the [STOP] key is pressed.	
	START	When the [START] key is pressed, the measurement is started. When the [START] key is pressed during measurement, the measurement is restarted.	
	STOP	When the [STOP] key is pressed, the measurement is stopped.	
	CURRENT DATA	OFF: The display is changed each time a measurement is completed. ON: The display is changed every second.	
	(LED)	When a red LED lights, it indicates that an alarm is currently being generated. When an orange LED lights, it indicates that an alarm was previously generated.	
	POWER FAIL	Lights when power goes off by methods other than by turning the POWER switch off and power is recovered.	
	SIGNAL LOSS	Lights when clock signals are disconnected.	
	SYNC LOSS	Lights when the error rate exceeds the following values: PRBS pattern: Approximately 1.3×10^{-1} Programmable pattern (the word length is 200 bits or less), 1/N pattern: Approximately 4.2×10^{-3} Programmable pattern (the word length is 208 bits or more): Approximately 4.2×10^{-4}	
	AIS	Lights when all 1 pattern is detected.	

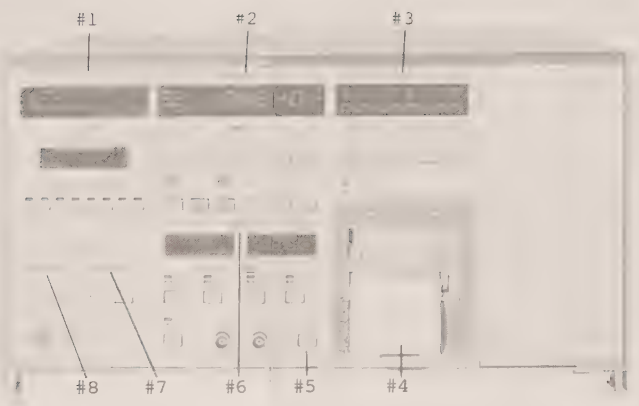


Fig. 3-4 Receiver Front Panel

Table 3-3 Explanation of Controls (Receiver Front Panel) (Contiued)

No.	Label	Function	Paragraph
#2 (cont.)	ERRORS	Lights when an error is detected.	
	GATING	Lights during measurement.	
	BUZZER	When this key is on (Key LED lights), the buzzer sounds during the above alarm (red LED lights) or when an error is detected.	
	AUTO SYNC	Usually set to ON.	
	HISTORY RESET	Turns off the orange LED.	
#3	TIME	This function displays and sets the time and measurement time.	3.4.2 (5
	REAL TIME	Displays the time (year, month, day, hour, minute, and second).	
	MEAS TIME		
	PRESET	Displays the preset measurement time (time or number of clocks).	
	TIMED	Displays the remaining measurement time.	
	ELAPSED	Displays the measurement elapsed time.	
	MEAS PERIOD	Switches setting of the measurement time by time (TIME) or number of clocks (CLOCK).	
		TIME setting method 1. Press the [YM] key or [DHMS] key to set the time. Press the [PRESET] key to preset the measurement time. 2. Press the [SET] key. Two settable digits start blinking. 3. Shift the blinking digits by using the [<] [>] keys. 4. Set the numeric values by using the [^] [V] keys. 5. Press the [SET] key after the setting is completed. TIME is set when the [SET] key is off.	

Table 3-4 Explanation of Controls (Receiver Rear Panel)

No.	Label	Function	Paragraph
#9	ALARM OUTPUT	The two terminals are normally open. When an alarm is generated, the two terminals are strapped.	3.4.2 (7)
#10	MONITOR INPUT	This input is used to record the state of the device under test together with an error rate when an error has occurred. (See #11 FUNCTION 2, bit 7.)	3.4.2 (7)
#11	FUNCTION 1 FUNCTION 2	These switches are used to expand the receiver function. The following two tables list the items related to MEASUREMENT, items related to the format of the data printed after the measurement is completed or during measurement for MEASURED DATA, and items related to the format of the data printed when an error is detected for ONE SECOND DATA.	3.4.2 (6) (7)

FUNCTION 1 Items indicated by a circle are the related item.

MEASUREMENT	MEASURED DATA	ITEMS	SWITCH 0	SWITCH 1	NO.
O		ERROR INTERVAL	ASYNC	SYNC	1
	O	THRESHOLD EI, EFI	OFF	ON (ASYNC)	2
	O	ERROR PERFORMANCE	OFF	ON (ASYNC)	3
O		ERROR PERFORMANCE THRESHOLD	10^{-3}	10^{-4}	4
O		VOLTAGE	MIN	MAX	5

Note: When bit 1 is 0 and bit 3 is 1, the error interval is always one second.

Bit 1: Switches the error interval measurement method.
Bit 2: Switches whether to print THRESHOLD EI or, FEI. Printing can be done only when bit 1 is 0.
Bit 3: Switches whether to print the error performance data. Printing can be done only when bit 1 is 0.
Bit 4: Switches the severely ES measurement threshold error rate of error performance.
Bit 5: Switches whether to measure the voltage at MONITOR INPUT #10 using the minimum or maximum value.

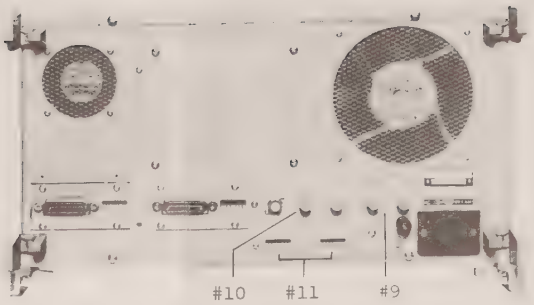


Fig. 3-5 Receiver Rear Panel

Table 3-4 Explanation of Controls (Receiver Rear Panel) (Continued)

No.	Label	Function	Paragraph

#11 FUNCTION 2

MEASURED DATA	ONE SECOND DATA	ITEMS		SWITCH 0	SWITCH 1		NO.
O		INTERMEDIATE PRINTING		OFF	ON		1
O		MEASURED DATA PRINTING		ALL DATA	E. RATE E. COUNT		2
			PRINTING	OFF	ON		3
			DATA	E. RATE	E. COUNT		4
				E. RATE	E. COUNT	6 5	
	O	ONE SECOND DATA	THRESHOLD	>0	≧1	0 0	5
				$>10^{-6}$	≧10	0 1	
				$>10^{-4}$	≧100	1 0	6
				$>10^{-3}$	≧1000	1 1	
			MONITOR INPUT	OFF	ON		7
			PAPER SAVING	OFF	ON		8

Bit 1: Switches whether to perform intermediate printig when the measurement time is long (2 hours or more). When ON, printing is performed every 2 hours at measurement time < 2 days or every 2 days at ≧2 days.
Bit 2: Switches the printing format of a measurement result.
"0" All data is printed.
"1" Only error rate and the number of errors are printed.
Bit 3: Switches whether to print.
Bit 4: Switches whether to print an error rate or number of errors.
Bit 5 and 6: Printing restriction. Printing is performed only when the error exceed the values in the table.
Bit 7: Switches whether to print the state of MONITOR INPUT #10.
Bit 8: Switches whether to interrupt printing for saving printer paper or continue printing. When ON, printing is performed as follows:
After printing has continued for 10 seconds, it is stopped and restarts when there is no error or the error doesn't exceed the values in the table for 10 seconds.

Table 3-3 Explanation of Controls (Receiver Front Panel) (Continued)

No.	Label	Function	Paragraph
#4	(Printer)	Prints the measured results and alarm contents. When the printer is not used, set the [PRINT] key to off.	3.4.2 (6)
#5	MANUAL PRINT	Prints the measured results during measurement at the printer.	
#6	INPUT	This function sets the clock and data input levels, and waveforms.	3.4.2 (1) (2)
	POLARITY LEVEL	Switches the polarity of the clock signals. ECL: Terminating resistor (50 Ω or 75 Ω) is connected to -2 V. VARIABLE (CLOCK): Corresponds to the transmitter VARIABLE level. No setting is required for the receiver. VARIABLE (DATA): THRESHOLD level must be set. $V_{th} = \frac{V_1 + V_2}{2}$ (V) When FORMAT is CMI, Vth = 0.0 V is fixed.	
	FORMAT	Switches the FORMAT corresponding to input signals.	
	PHASE ADJUST	Adjusts the phase between the clock input and data input.	
#7	CONTROL	When the receiver is controlled externally by the GP-IB or RS-232C interface, the REMOTE LED is on. The REMOTE LED is off when the LOCAL mode is selected.	
#8	PANEL LOCK	When this key is pressed, only the POWER switch can be operated.	

3.3 Power On

After the power switch has been switched on, the ME522A operates as follows.

[Power-on]
↓
[The previously used status is set]
↓
[LED test]

In the following cases, the ME522A operates as follows.

(1) Turning on the power switch while pressing the [LOCAL] key:

The ME522A is set to its initial state. For a detailed description, refer to paragraph 3.3.1.

(2) The self-test mode switch (SELF T) of the GP-IB switch is on:

The ME522A enters the self-test mode after the LED test. For details, refer to section 5.

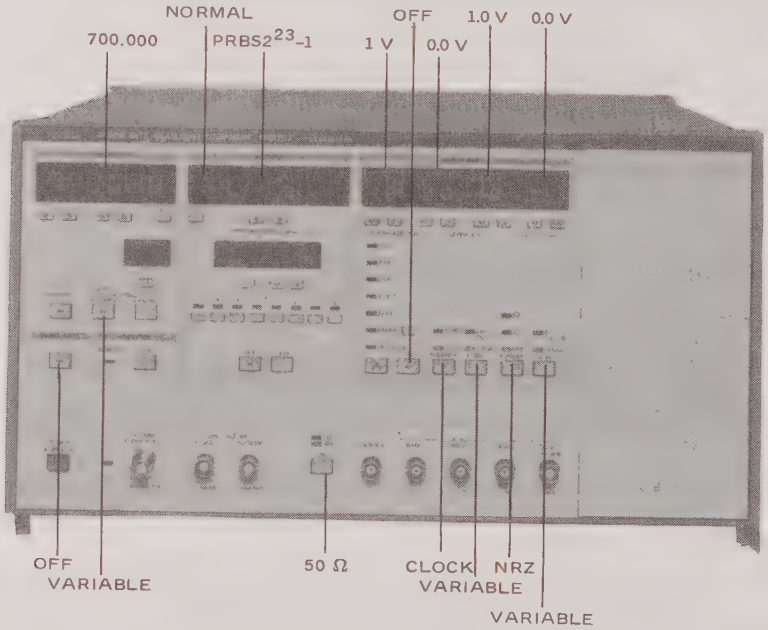
(3) The talk only (TON) and listen only (LON) switches of the GP-IB address switch are on:

The ME522A enters the pattern data transfer mode. In this mode, the pattern contents of the receiver are changed automatically when the pattern contents of the transmitter are changed. Refer to paragraph 3.5.

3.3.1 Initial state

When the power switch is turned on while pressing the LOCAL key, the ME522A is initialized except for the receiver clock. The initial state is as follows.

(1) Transmitter



CLOCK: MEMORY, F9

F1:	1.000 MHz	F2:	10.000 MHz
F3:	100.000 MHz	F4:	200.000 MHz
F5:	300.000 MHz	F6:	400.000 MHz
F7:	500.000 MHz	F8:	600.000 MHz
F9:	700.000 MHz		

PROGRAMMABLE WORD

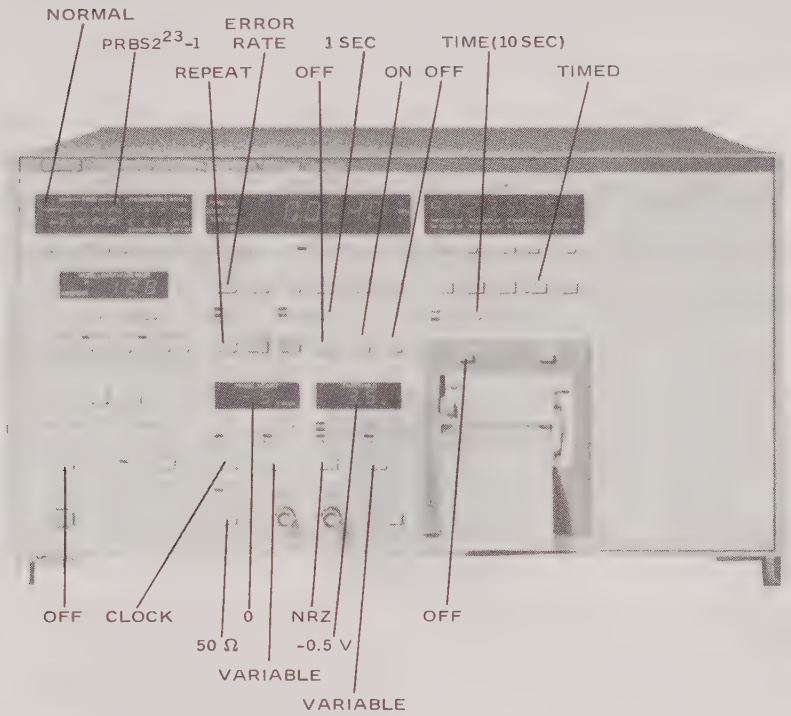
A: Mark ratio 1/2 pattern (N = 128)
B: Mark ratio 1/4 pattern (N = 128)
C: Mark ratio 1/8 pattern (N = 128)

ALT D/E:	D	1111	1111
	E	0000	0000

1/N: N = 12

Fig. 3-6 Initial State of Transmitter

(2) Receiver



PROGRAMMABLE WORD

A: Mark ratio 1/2 pattern (N = 128)

B: Mark ratio 1/4 pattern (N = 128)

C: Mark ratio 1/8 pattern (N = 128)

1/N: N = 12

MEAS PERIOD: CLOCK 10^9

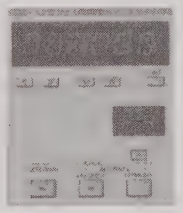
Fig. 3-7 Initial State of Receiver

3.4 Panel Description

3.4.1 Transmitter

(1) Clock

A synthesized clock generator is built into the transmitter. Therefore, frequencies in the range of 1 to 700 MHz can be set in 1 kHz steps. When changing the frequency, for example, the display changes as indicated in Fig. 3-8.



As shown in Fig. 3-8, the frequency that precedes a change is 123.456 MHz, and the blinking digit is 1 MHz.

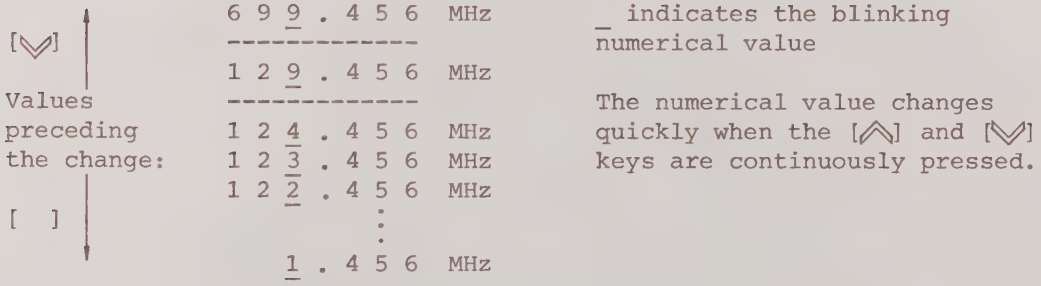

[⩒]
Values preceding the change:
[ ]
6 9 9 . 4 5 6 MHz
1 2 9 . 4 5 6 MHz
1 2 4 . 4 5 6 MHz
1 2 3 . 4 5 6 MHz
1 2 2 . 4 5 6 MHz
1 . 4 5 6 MHz
_ indicates the blinking numerical value
The numerical value changes quickly when the [⩓] and [⩒] keys are continuously pressed.

Fig. 3-8 Frequency Display Changes

The frequency of an output signal changes as soon as the numerical value is changed. Tat is, it is not necessary to press the [SET] key each time the frequency is set. Therefore, frequency response measurement can be more readily carried out.

(2) Pattern

(a) PRBS pattern

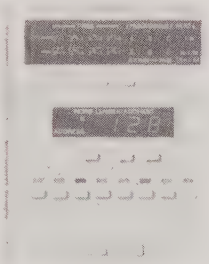
The PRBS pattern is pseudorandom pattern having characteristics that strongly resemble an actual line signal. For this reason it is most suitable for measurement. As indicated below, the ME522A has four pseudorandom patterns.

PRBS 2^7-1 : 1 period 127 bits

PRBS 2^{10}-1: 1 period 1023 bits

PRBS 2^{15}-1: 1 period 32767 bits

PRBS 2^{23}-1: 1 period 8388607 bits

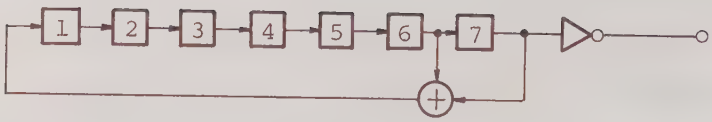


A pattern with a short period is used for pattern observation and/or for patterns having characteristics that resemble code-converted patterns. (For example, PRBS 2^7-1 in the case of a 5B/6B code.)

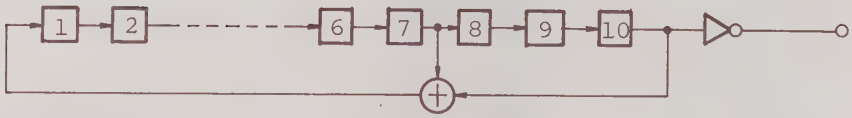
A pattern with a long period is used for measurement of ordinary equipment since it is closest to an actual line signal.

Shown in Fig. 3-9 is the method for generating a PRBS pattern. Two patterns can be generated by changing over the internal switches in regards to the PRBS 2^{15}-1 pattern. At the factory, it is set to the CCITT comformity pattern. Refer to paragraph 3.6.1 for information on the transmitter internal switches.

PRBS2^7-1

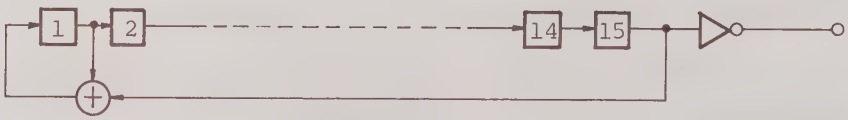


PRBS2^{10}-1



PRBS2^{15}-1: Conforms to CCITT
(Standard: 1st bit of internal switch is 0)

PRBS2^{15}-1: ANRITSU MEV7 compatible
(1st bit of internal swtich is 1)



PRBS2^{23}-1: Conforms to CCITT

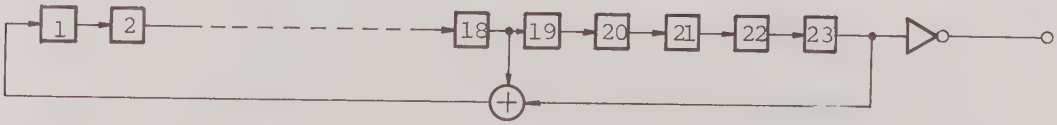


Fig. 3-9 PRBS Pattern Generation Method

(b) Programmable word pattern A, B, C

The programmable word pattern can test the influence of the pattern on the equipment by generating various patterns.

It can also be used in case patterns where a special bit composition are generated. The pattern can be set from 8 bits to 2048 bits in 8-bit steps. If a pattern with a 9-bit period is necessary, equivalent patterns can be obtained by setting a pattern of 9 x 8 = 72 bits.

To generate the programmable word pattern (called programmable pattern hereafter), the data which was stored in the memory in advance is sequentially read in word length N steps shown in Fig. 3-10. Therefore, even if the word length is changed, the previously set data is continuously memorized as is.

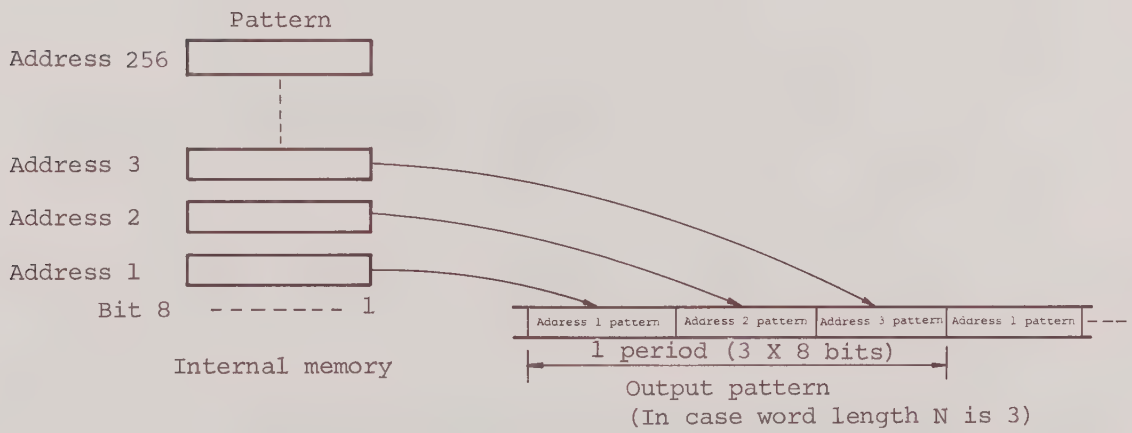


Fig. 3-10 Generation of Programmable Pattern

The ME522A has three independent internal memories which correspond to patterns A, B, and C. Although a change in the programmable pattern need not be carried out in the address sequence but can be changed from the desired address. An address pattern that exceeds the set word length N cannot be set. In this case, it is necessary to make word length N larger. The output pattern changes when the [SET] key is turned on.

The ME522A programmable pattern is protected while the power is off. The identical to the previous one can be generated when the power is turned on again.

Note:

Since the programmable pattern output will differ from the set pattern when the MH676A is plugged-in and its [MUX OPERATION] key LED is turned on. Refer to the MH676A Multiplexer/MH677A Demultiplexer operation manual.

(i) Mark ratio variable pattern

When the ME522A transmitter has been set to the initial state, the internal memory and output pattern become as shown in Fig. 3-11.

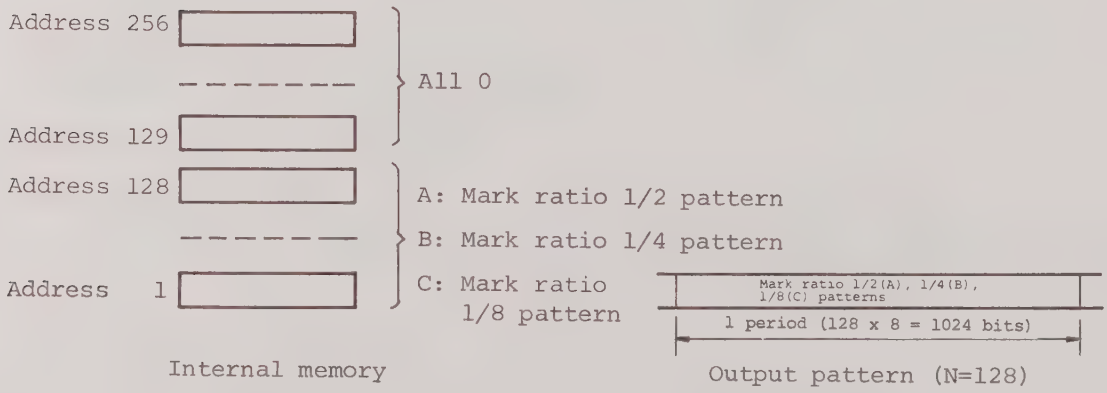


Fig. 3-11 Programmable Pattern at Initial State

The mark ratio is the ratio of marks "1" in regard to the entire bit.

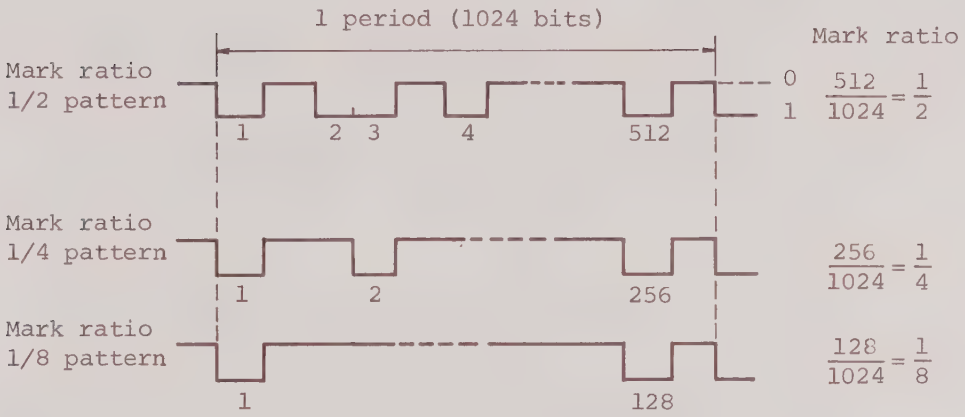


Fig. 3-12 Mark Ratio 1/2, 1/4, 1/8 Patterns

The mark ratio 1/2 pattern is generated based on PRBS 2^{10}-1 bit pattern as shown in Fig. 3-13 and its characteristics are nearly equal to the pseudorandom pattern. The mark ratio 1/4 and 1/8 patterns are generated based on mark ratio 1/2 pattern and have a random mark distribution.

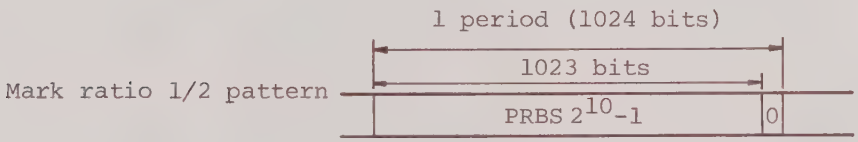


Fig. 3-13 Mark Ratio 1/2 Pattern

By inverting the pattern logic (1, 0) with the [LOGIC] key, mark ratio 3/4 and 7/8 patterns can also be generated. Refer to Fig. 3-14 for the mark ratio 7/8 pattern.

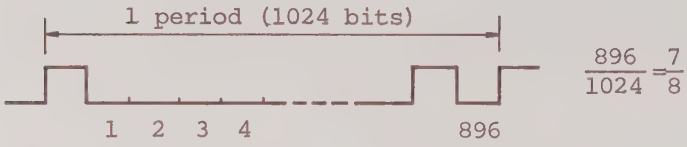
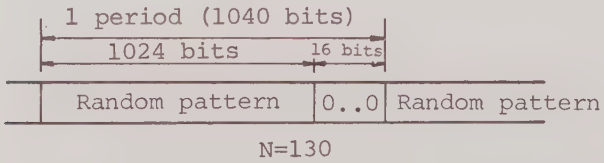


Fig. 3-14 Mark Ratio 7/8 Pattern (Pattern C)

The mark ratio variable pattern is convenient for testing circuits having mark ratio dependency, for example, clock regeneration circuits, O/E converter circuits, GaAs FET, etc.

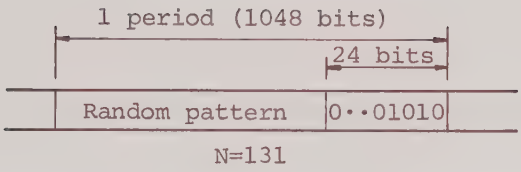
(ii) Zero insertion pattern

Random pattern + 0 insertion can be generated by using a programmable pattern in the initial state. The patterns of addresses 129 to 256 in the internal memory all become 0 as indicated in Fig. 3-11 under the initial status. Accordingly, by using pattern A, the 0 insertion pattern can be easily obtained by merely increasing the word length N.



(a) Random pattern + 16 bits* continuous 0

* Since the start bit of the random pattern is 0, continuous 17 bits become 0.



This pattern can be obtained by setting the address 131 pattern to 00001010.

(b) Random pattern +20 bits continuous 0

Fig. 3-15 Zero Insertion Pattern

(c) Alternate pattern (ALT D/E)

The alternate pattern is shown in Fig. 3-16.

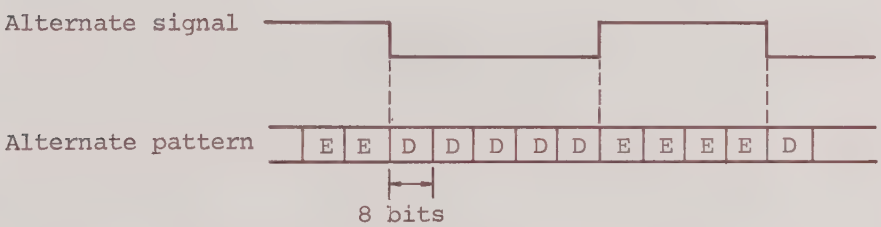


Fig. 3-16 Alternate Pattern (ALT D/E)

The alternate signal is the signal that is added to the ALT INPUT connector on the rear panel. The input alternate signal is standardized at an 8-bit width. The pattern D/E is a programmable 8-bit pattern. Pattern D is output where the alternate signal level is low; pattern E is output where it is high. The alternate pattern is used for jitter measurement.

(d) Isolated pattern (1/N pattern)

The isolated pattern is shown in Fig. 3-17.

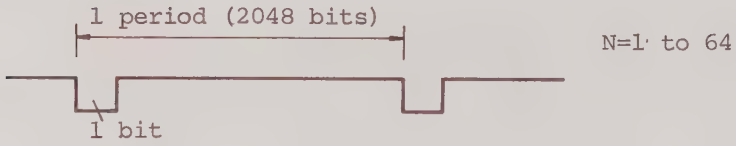


Fig. 3-17 Isolated Pattern (1/N pattern)

Although an isolated pattern of up to 1/64 only can be set, if a programmable pattern is used this setting can be extended to 1/2048.

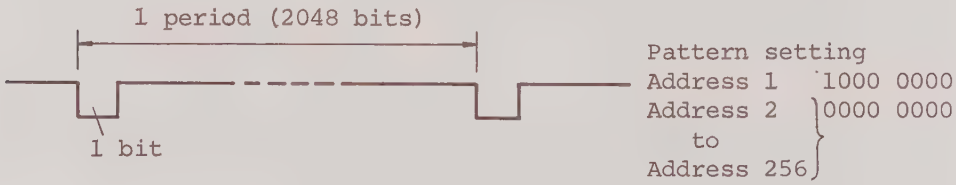


Fig. 3-18 1/2048 Pattern

The 1/1 patterns are all 1 patterns.

(e) Logic inversion pattern

The ME522A can invert the logic (1, 0) regarding all patterns. Examples are shown in Fig. 3-19.

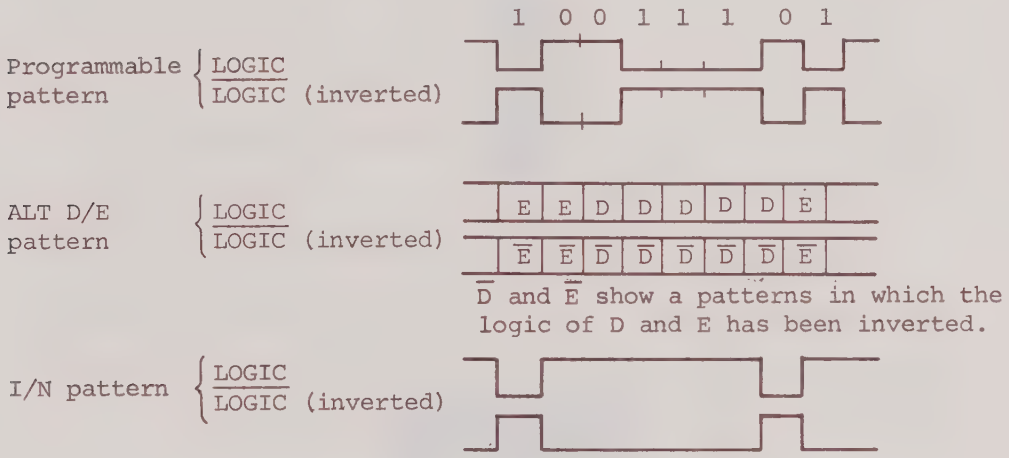

1 0 0 1 1 1 0 1
Programmable pattern
LOGIC
LOGIC (inverted)
ALT D/E pattern
LOGIC
LOGIC (inverted)
E E D D D D D Ē
Ē Ē D D D D D E
D and E show a patterns in which the logic of D and E has been inverted.
I/N pattern
LOGIC
LOGIC (inverted)

Fig. 3-19 Logic Inversion

(f) Gate

The ME522A can apply a gate to all patterns.

Fig. 3-20 Gate

The pattern is inhibited while the gate signal is low.

(3) Error addition

The error addition is used to check the measurement system and to check the operation of the receiver.

Figure 3-21 shows the method for checking the measurement system. This is done by checking that the number of errors detected by the receiver is equal to the number of errors added by the transmitter.

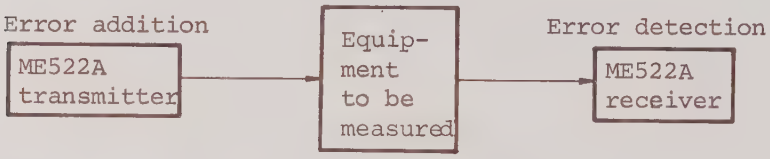


Fig. 3-21 Measurement System Check

Errors are added to all data output, 1 to 6.

. External errors

If the external error addition function is used, the error of the desired error rate can be added. A 1-bit error is added by every trailing edge of a signal applied to the rear panel EXTERNAL ERROR INPUT connector.

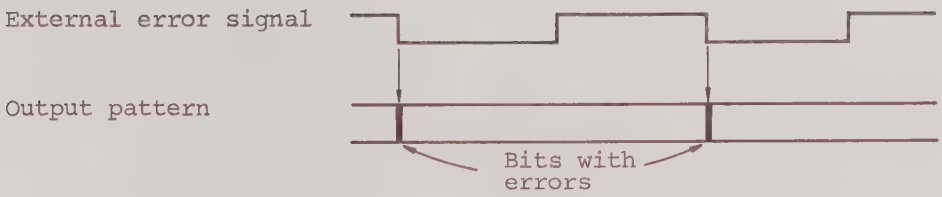
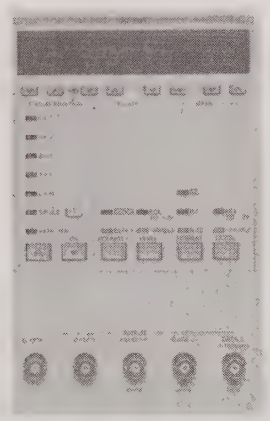


Fig. 3-22 External Error Addition

(4) Output waveform, level, phase

Although the waveforms and levels of CLOCK 1 output and DATA 1 output are set by the OUTPUT keys, the other outputs are fixed as shown hereunder.



CLOCK 2 output: level 0/-1 V

DATA 2 output: level 0/-1 V, waveform NRZ

DATA 3 to 6 outputs: level 1 Vp-p, waveform CMI

(a) Output waveform

Figure 3-23 shows a definition of the waveforms of the transmitter output signals.

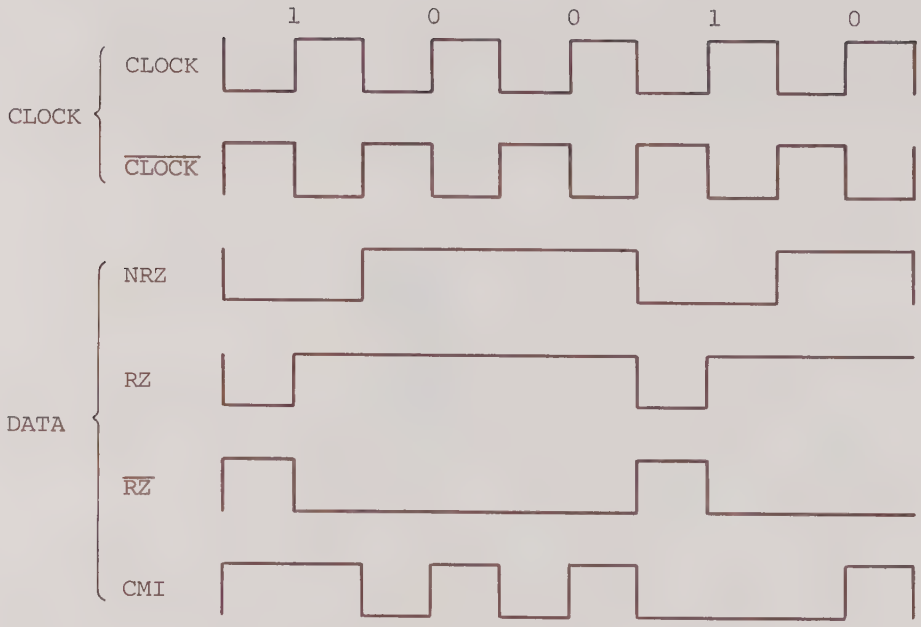


Fig. 3-23 Definition of Transmitter Output Waveforms

(b) Level

(i) VARIABLE

. Amplitude

As shown in Fig. 3-24, the amplitude can be changed in the 1 to 3 V range in 0.05 V steps (display in 0.1 V steps) by [^] and [v] keys.

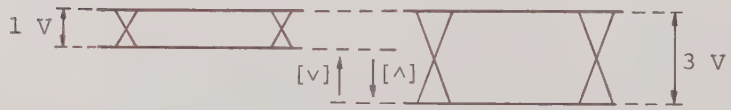


Fig. 3-24 Amplitude

. Offset

As shown in Fig. 3-25, the offset voltage can be changed in the -1 to +4 V range in steps of 0.05 V (display in 0.1 V steps) by [⩓] and [⩔] keys.

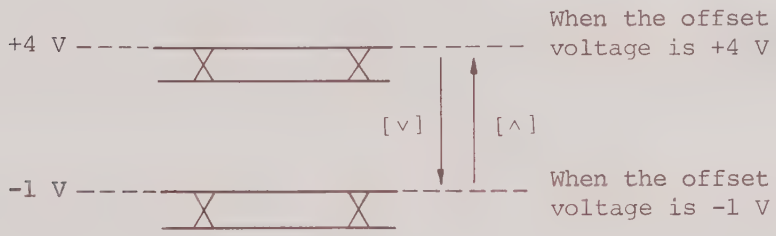


Fig. 3-25 Offset

(ii) ECL

The output level is fixed at the value given in Fig. 3-26.

Fig. 3-26 ECL Level

However, it is necessary that the transmitter output be terminated as shown in Fig. 3-27.

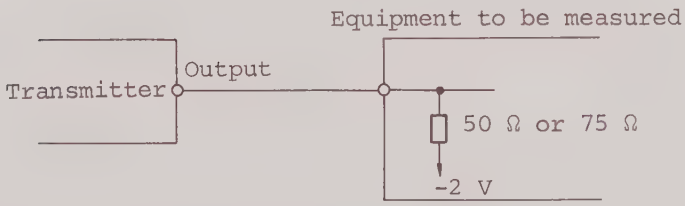


Fig. 3-27 Termination Method

(c) Phase

The phase difference between data output is as follows.

(i) DATA 1 output and DATA 2 output

PRBS pattern: 1/2 of PRBS pattern

Programmable pattern: In-phase

(ii) Data outputs 3, 3, 5, 6 (CMI output).

In-phase

(5) LOAD

With a digital system, impedance matching is necessary when it is connected between equipment. An example is shown in Fig. 3-28.

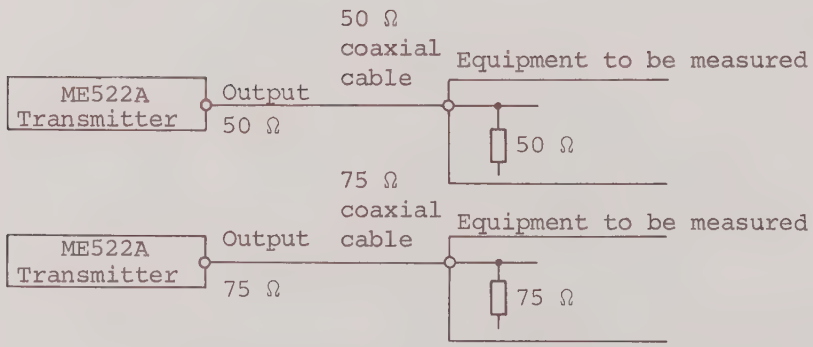


Fig. 3-28 Impedance Matching

3.4.2 Receiver

(1) INPUT DATA

(a) Input waveforms

The waveforms, logic, and threshold voltage of the receiver input signals are defined in Fig. 3-29.

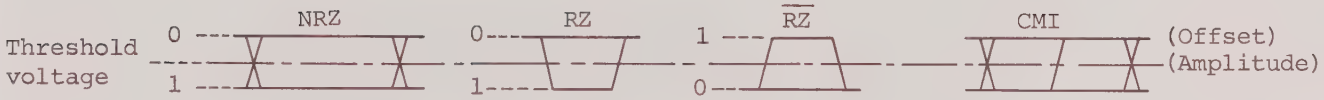
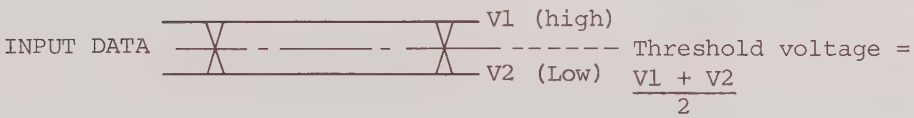


Fig. 3-29 Definition of Receiver Input Waveforms

(b) Level

(i) VARIABLE

Use the THRESHOLD [ ] and [⩓] keys to set the THRESHOLD display voltage to the threshold voltage of the input data (see Fig. 3-30).



(a) When the high and low levels are known:

(b) When the amplitude and offset are known:

Fig. 3-30 Setting of Threshold Voltage

Notes:

1. Although the internal threshold is changed every 0.05 V by pressing the [⩔] or [⩓] key, the THRESHOLD display voltage only changes in 0.1 V steps.
2. When the INPUT DATA is CMI, the THRESHOLD display voltage is fixed at 0.0 V and the [ ] and [⩓] keys cannot be operated.

(ii) ECL

The terminal resistor of the receiver is connected to -2 V (see Fig. 3-31). The threshold voltage is fixed at -1.3 V.

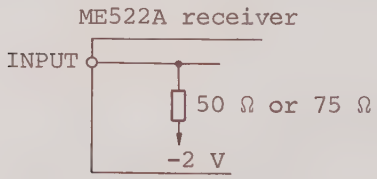


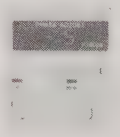
Fig. 3-31 Receiver Termination

(2) INPUT CLOCK

(a) Level

(i) VARIABLE

Set the LEVEL to VARIABLE when the level of the input signal is as follows.



Amplitude: 1 to 3 V; offset: -1 to +4 V

(ii) ECL

The terminal resistor of the receiver is connected to -2 V (see Fig. 3-32).

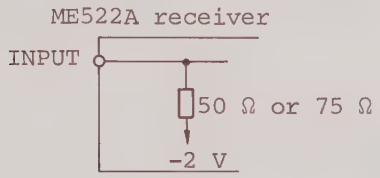


Fig. 3-32 Receiver Termination

(b) POLARITY

Set the [POLARITY] key as shown in Fig. 3-33 according to the phase of the input clock with respect to the input data.

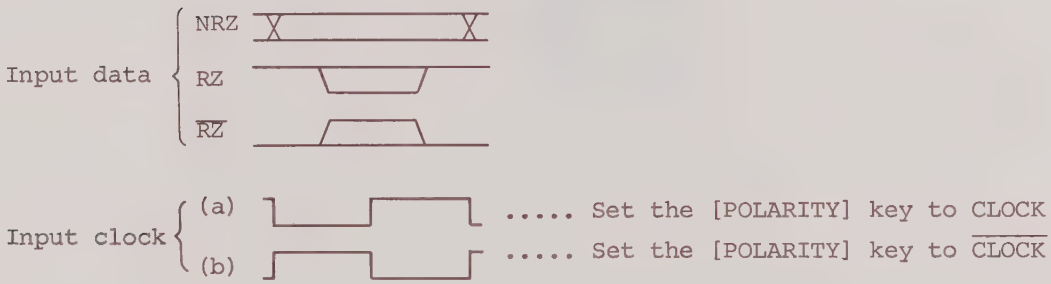


Fig. 3-33 POLARITY

(c) PHASE ADJUST

PHASE ADJUST is used to set the phase between the input clock and data to the optimum position, and whenever the phase relation between the input clock and data is unclear. Use the PHASE ADJUST [⩔] and [⩓] keys to search for the PHASE ADJUST range so the "ERRORS" LED goes off. Then set the PHASE ADJUST display value in the center of that range. Refer to Fig. 3-34 for the method on using PHASE ADJUST.

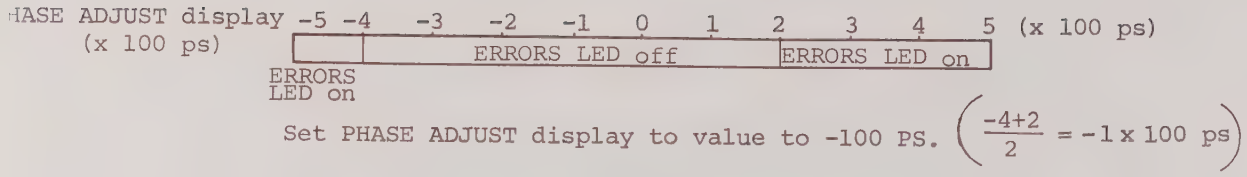
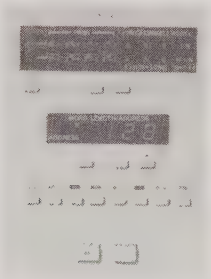

HASE ADJUST display
(x 100 ps)
-5 -4 -3 -2 -1 0 1 2 3 4 5 (x 100 ps)
ERRORS LED off
ERRORS LED on
ERRORS
LED on
Set PHASE ADJUST display to value to -100 PS. $\left(\frac{-4+2}{2} = -1 \times 100 \text{ ps}\right)$

Fig. 3-34 PHASE ADJUST

(3) PATTERN

Set the same pattern as that of the transmitter pattern. For a detailed description, refer to paragraph 3.4.1 (2).

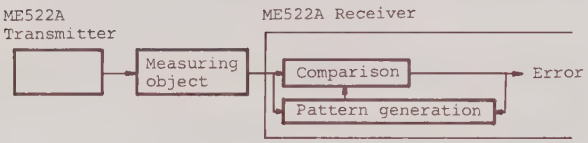


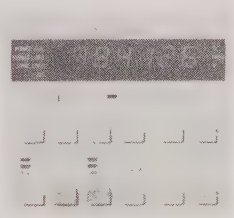
Note:

When the MH677A demultiplexer is plugged-in and the MH677A [DEMUX OPERATION] key is on, the programmable word pattern will be different from the set pattern. Exercise care. Refer to the MH676A multiplexer/MH677A demultiplexer operation manual.

(4) MEASUREMENT

Errors are detected by comparison of the input pattern and the internally generated pattern, which is the same as that of the transmitter, bit by bit as shown in the following figure.





(a) Measurement items

All measurement is carried out at the same time and only the item selected with the DISPLAY keys is displayed. ERROR INTERVAL and ERROR FREE INTERVAL measurements are performed at the following set intervals only (1 s, 0.1 s, or 0.01 s).

(i) ERROR RATE

$$\text{Error rate} = \frac{\text{Number of error pulses}}{\text{Number of clock pulses}}$$

Measuring range: 1 to 1.0×10^{-16}

(ii) ERROR COUNT

Number of error pulses during the measuring time

Measuring range: 1 to 99999,
1×10^{5} to 9.9×10^{16}

(iii) ERROR INTERVAL (EI)

Number of intervals in which at least one or more errors has occurred within the measuring time.

The interval can be selected as 1 s, 0.1 s, or 0.01 s.

The error interval may be synchronous or asynchronous. They are selected with the 1st bit of the FUNCTION 1 switch on the rear panel.

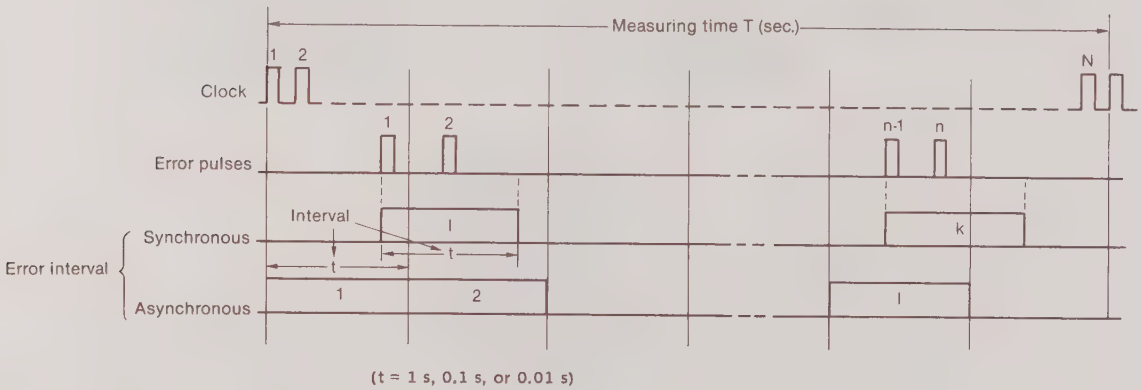


Fig. 3-35 Error Interval

Measuring range: 1 to 99999, 1×10^5 to 9.9×10^{16}

(iv) ERROR FREE INTERVAL (EFI)

EFI is the Ratio of the time without errors, and it is calculated according to the following formula.

$$EFI = \frac{\text{Measuring time} - EI \times \text{interval}}{\text{Measuring time}} \times 100\%$$

Measuring time: 0 to 100%

(v) FREQUENCY

The clock frequencies below are displayed.

Unipolar pattern (NRZ, RZ, $\overline{RZ}$): INPUT CLOCK

CMI pattern: Regeneration clock of INPUT DATA

The measured results are displayed at 1 sec intervals regardless of the [CURRENT DATA] key. Also, frequency is displayed during measurement interrupt.

Note:

Note the following when the PATTERN is set to PROGRAMMABLE WORD pattern.

When the [AUTO SYNC] key LED and SYNC LOSS LED are on, the measured frequency is lower than a normal value. To display the normal value, turn the [AUTO SYNC] key LED off.

Measuring range: 1 to 700 MHz

(vi) VOLTAGE

The voltage applied to the rear panel MONITOR INPUT VOLTAGE terminals is displayed. (Refer to paragraph 3.4.2 (7).)

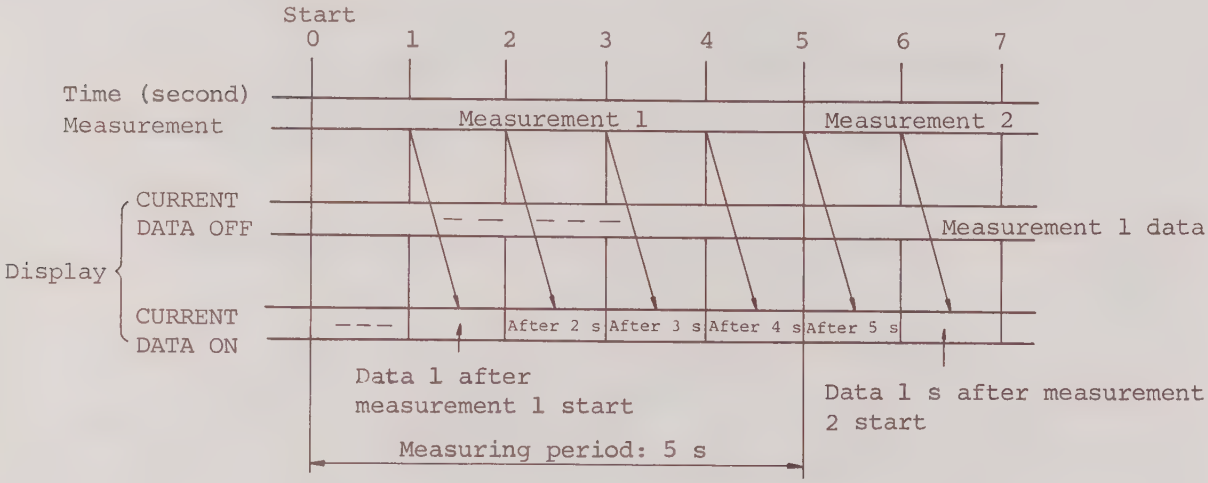
The measured results are displayed at 1 intervals without regard to the [CURRENT DATA] key. The voltage is displayed even during measurement interrupt.

Measuring range: 0 to 20 V

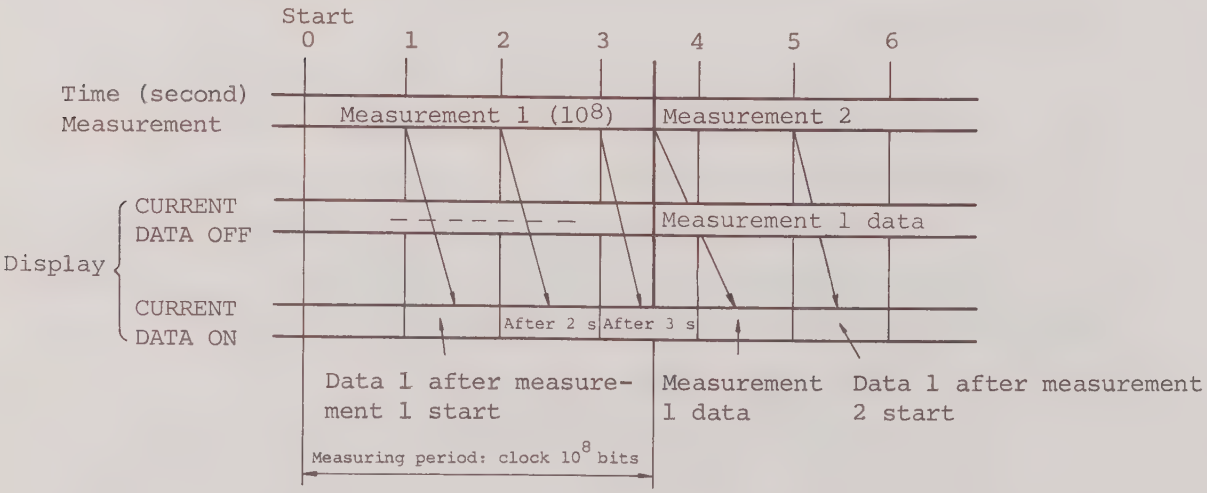
(b) CURRENT DATA

The intermediate measured result is displayed at 1 s intervals while the [CURRENT DATA] key is on: the final measured result is displayed upon completion of each measurement while the [CURRENT DATA] key is off.

An example is shown in Fig. 3-36.



(a) When the measuring period is set by TIME



(b) When the measuring period is set by CLOCK

Fig. 3-36 CURRENT DATA

When the SIGNAL LOSS LED is lit, the display becomes "-----".

(c) Measuring mode

Measurement is possible in three modes; single, repeat, and untimed (manual). Restart and stop during measurement are possible.

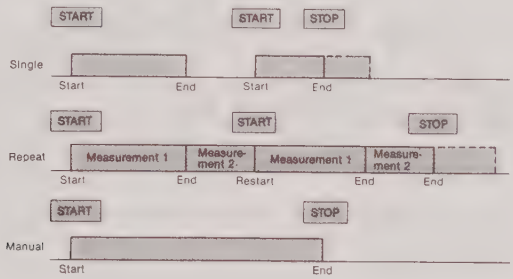


Fig. 3-37 Measuring Mode

By setting the measuring time (TIME or CLOCK) to the desired time when the mode is REPEAT and SINGLE, the respective repeat measurement and single measurement are carried out. (Refer to paragraph 3.4.2 (5) when setting the measuring time.)

When the mode is UNTIMED, the measuring time starts from the time that the [START] key is pressed and ends when the [STOP] key is pressed. Measurement is completed when the measuring time reaches a maximum of 100 days. Measurement starts when the [START] key is pressed; it ends when the [STOP] key is pressed.

(d) Alarm LEDs

The receiver has two types of alarm LEDs as shown below.

. The red LEDs stay lit while the alarm is on.

. The orange LEDs indicate that the alarm is being memorized.

Press the [HISTORY RESET] key to cancel the orange LEDs.

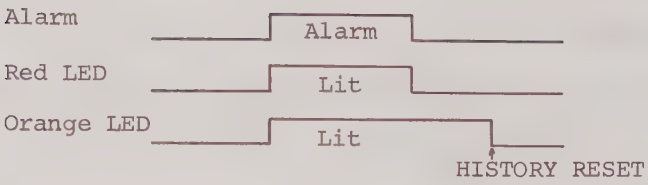


Fig. 3-38 Alarm LEDs

(i) POWER FAIL (Orange LED only)

Even during power failure, all information (switch information, measurement data, real time, etc.) is held.

Measurement is stopped when the power is interrupted and it is restarted when the power recovers.

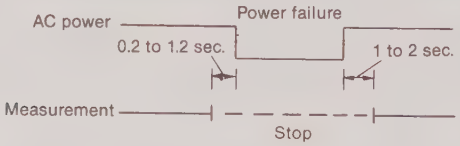


Fig. 3-39 Power Failure

(ii) SIGNAL LOSS

A signal loss can be considered when the following occurs:

Unipolar pattern (NRZ, RZ, $\overline{\text{RZ}}$): No input clock

CMI pattern: No input data or input data other than 139.264 MHz.

In a case where the measuring time is set with CLOCK (see paragraph 3.4.2 (5)), measurement is stopped at the point when a signal loss occurs. Measurement is restarted when the signal loss is recovered.

(iii) SYNC LOSS

When synchronization of the pattern is achieved, if the error rate exceeds the SYNC LOSS threshold value shown in Table 3-5, it is regarded as the SYNC LOSS.

In the SYNC LOSS state, when the error rate is at the SYNC LOSS recovery threshold value or less, as shown in Table 3-5, it is regarded as a SYNC LOSS recovery.

Table 3-5 Synchronization Threshold Value

		Error rate	
		SYNC LOSS threshold value	SYNC LOSS recovery threshold value
PRBS PATTERN (2^7-1, 2^{10}-1, 2^{15}-1, 2^{23}-1)		$\frac{1.5 \times 10^5}{1.2 \times 10^6} \fallingdotseq 1.3 \times 10^{-1}$	$\frac{16}{2000} \fallingdotseq 8 \times 10^{-3}$
PROGRAMMABLE WORD PATTERN	A, B, C (8 to 200 bits) 1/N (N = 1 to 64)	$\frac{5100}{1.2 \times 10^6} \fallingdotseq 4.2 \times 10^{-3}$	$\frac{16}{4700} \fallingdotseq 3.4 \times 10^{-3}$
	A, B, C (208 to 2048 bits)	$\frac{510}{1.2 \times 10^6} \fallingdotseq 4.2 \times 10^{-4}$	$\frac{16}{6 \times 10^4} \fallingdotseq 2.6 \times 10^{-4}$

(iv) AIS

AIS is realized under the following conditions.

"0" in data having approx. 3200 bits clock length is 4 bits or less

Note:

The AIS LED (red) goes out at SIGNAL LOSS.

(e) AUTO SYNC

The [AUTO SYNC] key is turned on for ordinary measurement. When the error rate exceeds the SYNC LOSS threshold value in Table 3-5, measurement is performed by operating the [AUTO SYNC] key as described below.

1. If the error rate is lower than the SYNC LOSS threshold value in Table 3-5, achieve pattern synchronous by turning on the [AUTO SYNC] key.

2. Once synchronization is achieved, lock the synchronous circuit by turning off the [AUTO SYNC] key. However, if the error rate is higher than the SYNC LOSS threshold value at the beginning measurement can not be carried out. When the [AUTO SYNC] key is off or SIGNAL LOSS has occurred, the SYNC LOSS LED (red) goes out.

(5) Time setting

(a) Measuring time

The measuring time must be set in advance when the [MEAS MODE] key is at REPEAT or SINGLE. The measurement time is set by the time or number of clock pulses. The receiver displays both the time remaining and the elapsed time. The time remaining and the elapsed time are displayed even if the measuring time is set by the number of clock pulses.

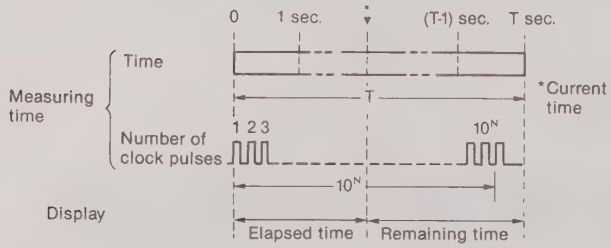


Fig. 3-40 Measuring Time

(i) TIME

This is used in cases where the measuring time is long, for example, 1 hour or more, or where measurement is performed in blocks of time. The relation between the measuring time and the minimum measurable error rate is given below.

$$\text{Minimum error rate} = \frac{1}{\text{Measuring time (second)} \times \text{Frequency (Hz)}}$$

For example, the minimum error rate becomes approx. 1.8×10^{-10} when the measuring time is 10 s and the frequency 565 MHz. Measurement will be carried out at the initially set time even if a power failure occurs during measurement.

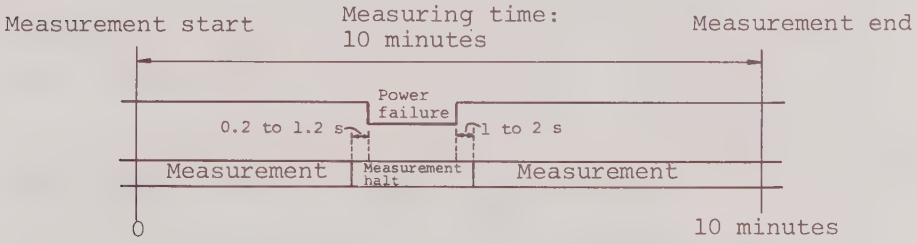
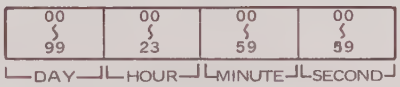


Fig. 3-41 Power Failure

. Setting method

1. Set the [MEAS PERIOD] key to TIME.
2. Turn the DISPLAY [TIME] key on.



3. Press the [SET] key.
4. Set the DAY, HOUR, MINUTE, SECOND by means of the [≪], [≫] and [≪], [≫] keys.
5. Press the SET key again; the time is set at this point.

(ii) CLOCK

This is used in order to carry out measurements based on the minimum error rate to be measured. For example, if an error rate up to 10^{-9} is to be measured, use this mode to set the number of clock pulses to 10^{9}. The relation between the number of clock pulses and the measuring time is given below.

$$\text{Measuring time} = \frac{\text{Number of clock pulses}}{\text{Frequency (Hz)}}$$

The measuring time is approximately 1.8 s when the number of clock pulses is 10^{9} and the measurement frequency is 565 MHz. Measurement will be performed up to the initially set number even if a power failure occurs during measurement.

Measurement will halt at the point where a SIGNAL LOSS occurs during measurement. It will restart at the point where the SIGNAL LOSS is recovered.

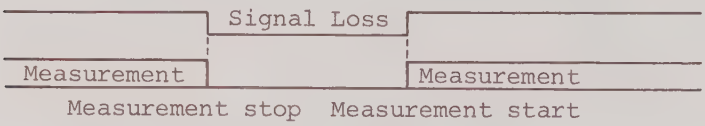
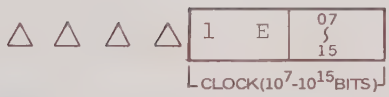


Fig. 3-42 SIGNAL LOSS

. Setting method

1. Set the [MEAS PERIOD] key to CLOCK.
2. Turn the DISPLAY [PRESET] key on.



3. Press the [SET] key.
4. Set the number of clock pulses by means of the [⩛] and [⩓] keys.
5. Press the [SET] key again. The number of clock pulses is set at this point.

Note:

Measurement is not performed and "ΔΔ ΔΔ FL" is displayed when the set value of the number of clock pulses converted to time is 100 days or more.

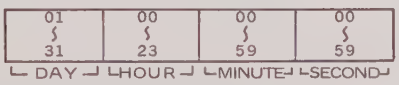
(b) Rear time

The receiver has a real-time clock with calender. Measurement is carried out according to this clock.

The setting method is as follows.

1. Turn the REAL TIME [YM] or [DHMS] key on.
2. Press the [SET] key.

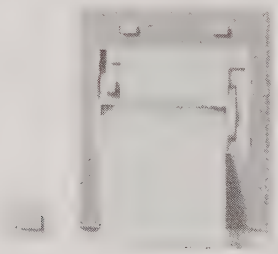
3. Set the YEAR, MONTH or DAY, HOUR, MINUTE, SECOND by [⩤], [⩥] and [⩛], [⩓] keys.



4. Press the [SET] key again. The time will change at that point.

(6) Printer

The printer prints the measured results (measured data, alarm) and error analysis data.



There are five kinds of printing data.

. Measurement start data

. Measurement end data

. Intermediate data

. One second data

. Alarm data

The FUNCTION 1 and FUNCTION 2 switches on the rear panel are used to select and limit the contents to be printed. (Refer to paragraph 3.4.2 (7).)

The direction of the printing is determined by the internal switches. (Refer to paragraph 3.6.2.)

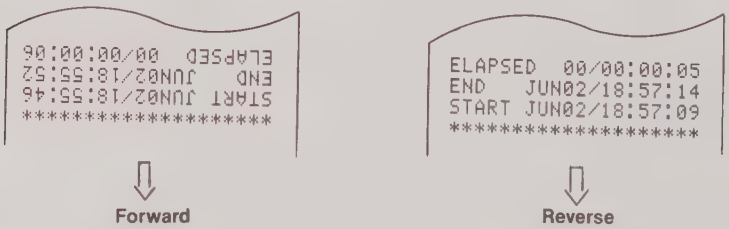


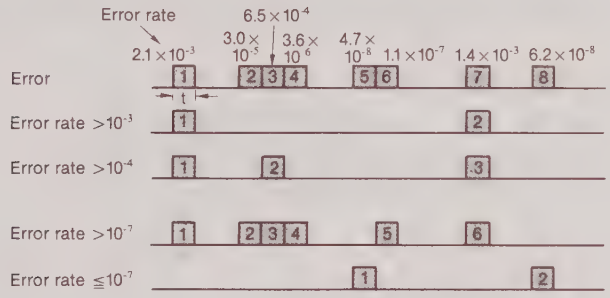
Fig. 3-43 Printing Direction

(a) Error analysis data

(i) Threshold EI and EFI

. Threshold EI

Number of intervals which satisfy the threshold conditions in the measuring time.
(Threshold conditions: error rates in set interval $>10^{-3}$, $>10^{-4}$, $>10^{-5}$, $>10^{-6}$, $>10^{-7}$, $\leqq 10^{-7}$)



t: Time selected by the INTERVAL (0.01 s, 0.1 s, 1 s)

Fig. 3-44 Threshold EI

. Threshold EFI

The threshold EFI is calculated as follows.

$$\text{Threshold EFI} = \frac{\text{Measuring time - threshold EI x interval}}{\text{Measuring time}} \times 100\%$$

(ii) Error performance data

The error performance data are the measurement items recommended in CCITT G.821.

. Error free seconds (EFS)

$$EFS = \frac{\text{Sum of the seconds without errors}}{\text{S-avail*}} \times 100(\%)$$

. Errored seconds (ES)

$$ES = \frac{\text{Sum of the seconds with at least one error}}{\text{S-avail}} \times 100\%$$

. Severely ES (SES)

$$SES = \frac{\text{Sum of the seconds with an error rate exceeding the Eth}}{\text{S-avail}} \times 100\%$$

Eth can set to 10^{-3} or 10^{-4} by the FUNCTION 1 switch on the rear panel. (Refer to paragraph 3.4.2 (7).)

. Degraded minutes (DM)

$$DM = \frac{Md \times 60}{\text{S-avail}} \times 100\%$$

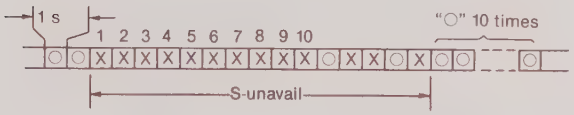
Md: First, the seconds where the error rate exceeds Eth in a second are removed from S-avail and the remaining seconds are consecutively grouped into blocks of 60. Md is the sum of blocks where the error rate in the block has exceeded 10^{-6} or 10^{-8} (10^{-6} when Eth is 10^{-3}, and 10^{-8} when it is 10^{-4}).

. Unavailable seconds (US)

$$US = \frac{\text{S-unavail}}{\text{Measuring time - power fail time}} \times 100\%$$

S-unavail:

Time from the time that the condition where the error rate in a second has exceeded Eth or the signal loss condition has existed continuously for at least 10 s, until a different condition has continued for at least 10 s.



X: The error rate in a second has exceeded Eth or the signal is lost.
○: Other than the above.
*S-avail = Measuring time – power failure time – S-unavail – signal loss time other than S-unavail

Fig. 3-45 S-unavail

(b) Printing contents

The printing contents are shown in Table 3-6.

Table 3-6 Printing Contents

	Types of data	Printing contents	Printing execution	Printing restriction
1	Measurement start data	. Measurement start time	. Prints at measurement start	
2	Measurement end data	. Measurement start time . Measurement end time . Elapsed time . Measured results (Measurement data: error rate, error number, EI, EFI alarm second: POWER FAIL, SIGNAL LOSS, SYNC LOSS, AIS) . Error analysis data . Threshold EI and EFI . Error performance data	Prints at measurement end	Prints at measurement end The following are available for selection . Printing of all data or abbreviated data . Existence of threshold EI and EFI printing . Existence of error performance data printing (Refer to Paragraph 3.4.2 (7).)

Table 3-6 Printing Contents (Continued)

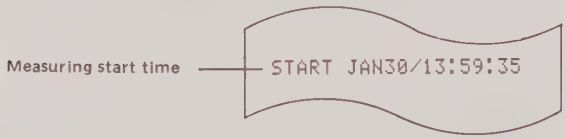
	Types of data	Printing contents	Printing execution	Printing restriction
3	Inter-mediate data	Same as the above measurement end data However, the measurement end time is changed to the intermediate time.	. When [MANUAL PRINT] key is pressed . At the following times when intermediate printing is on (When FUNCTION 2 switch bit 1 is 1) Every two hours when measuring time is < two days Every two days when measuring time is $\geq$2 days However, no printing takes place when the [MEAS MODE] key is set at UNTIMED	Same as measurement end data
4	One second data	Average error rate or number of errors in 1 s when an error has occurred Time of occurrence Error rate of error number Monitor input (Voltage and status)	Printing at each second	Selectable at the following (Refer to paragraph 4.2.2 (7).) Existence of printing Printing contents (error rate or error number) Printing restriction by error rate or error number Existence of monitor input printing Existence of printing paper saving
5	Alarm data	. POWER FAIL, SIGNAL LOSS, SYNC LOSS, and AIS occurrence time and recovery time. . Alarm contents	Printing at time of alarm occurrence and alarm recovery POWER FAIL is printed out at time of power recovery	

(c) Printing format and rear panel FUNCTION 1 and 2 switch settings

Shown below is the printing example and the method of switch setting.

The setting of switches not indicated is optional.

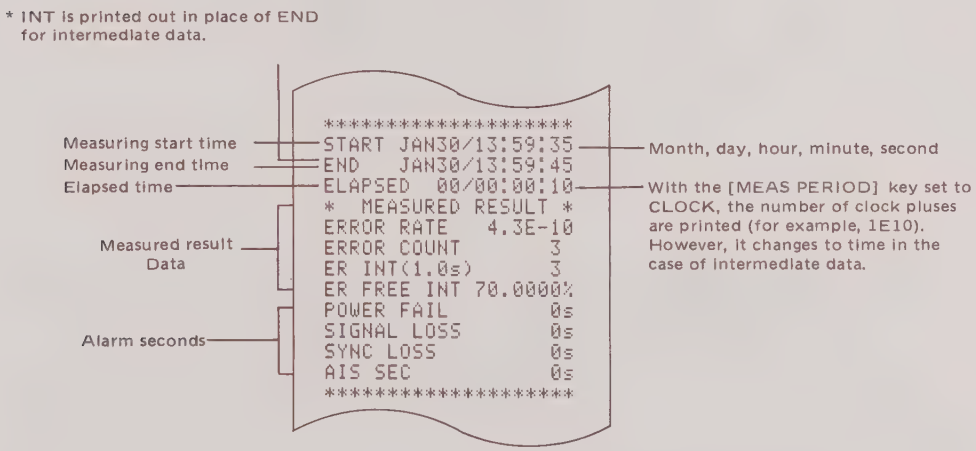
(i) Measurement start data



Setting the switches is not necessary.

Fig. 3-46 Printing Format for Measurement Start Data

(ii) Measurement end data and intermediate data

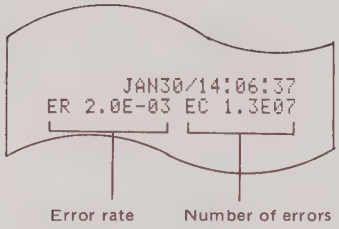

* INT is printed out in place of END for intermediate data.
Measuring start time
Measuring end time
Elapsed time
Measured result Data
Alarm seconds
****
START JAN30/13:59:35
END JAN30/13:59:45
ELAPSED 00/00:00:10
* MEASURED RESULT *
ERROR RATE 4.3E-10
ERROR COUNT 3
ER INT(1.0s) 3
ER FREE INT 70.0000%
POWER FAIL 0s
SIGNAL LOSS 0s
SYNC LOSS 0s
AIS SEC 0s
****
Month, day, hour, minute, second
With the [MEAS PERIOD] key set to CLOCK, the number of clock pluses are printed (for example, 1E10). However, it changes to time in the case of intermediate data.

Switch settings:

	FUNCTION 1	FUNCTION 2
	Bit 2 = 0	Bit 1 = 0 or 1*
	Bit 3 = 0	Bit 2 = 0

(a) Ordinary data (Format at shipment)

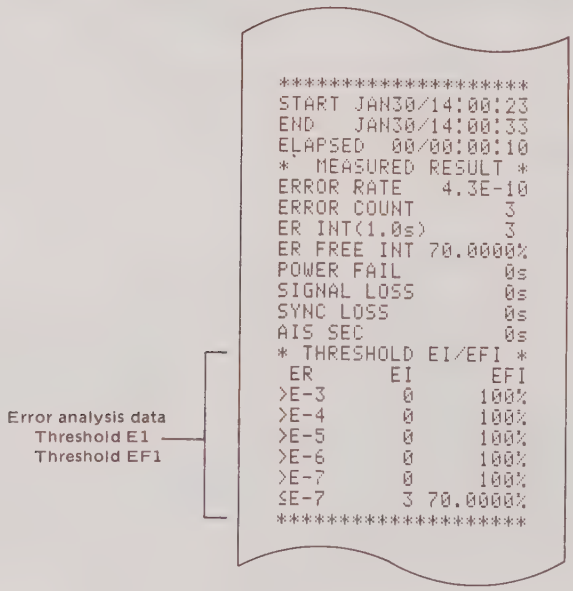
Fig. 3-47 Printing Format for Measurement End Data and Intermediate Data



Switch settings: FUNCTION 2 Bit 1 = 0 or 1*
Bit 2 = 1

(b) Abbreviated data

*: Set to 1 when intermediate printing is carried out.



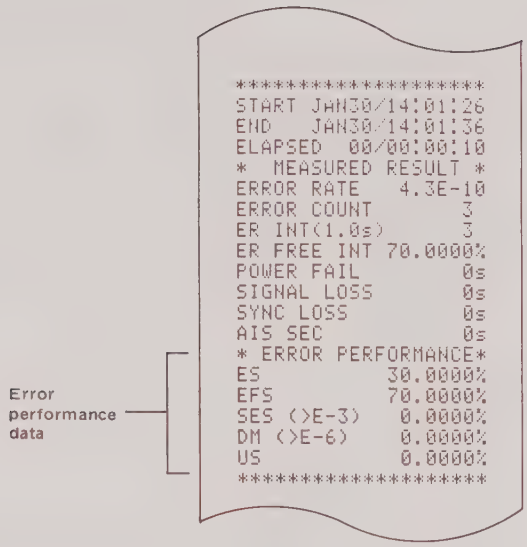
Switch settings: FUNCTION 1 FUNCTION 2

Bit 1, 3 = 0 Bit 2 = 0

Bit 2 = 1

(c) Ordinary data + threshold EI, EFI

Fig. 3-47 Printing Format for Measurement End Data and Intermediate Data (Continued)



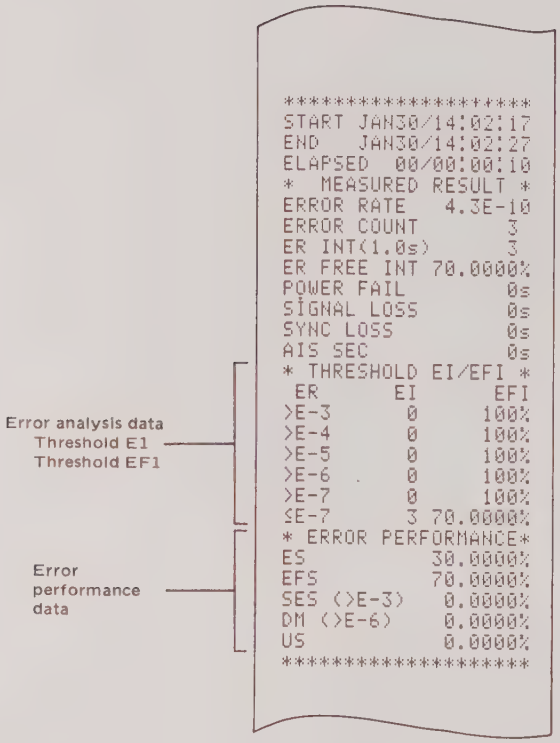
Switch settings: FUNCTION 1 FUNCTION 2

Bit 1, 2 = 0 Bit 2 = 0

Bit 3 = 1

(d) Ordinary data + error performance data

Fig. 3-47 Printing Format for Measurement End Data and Intermediate Data (Continued)



Switch settings: FUNCTION 1 FUNCTION 2

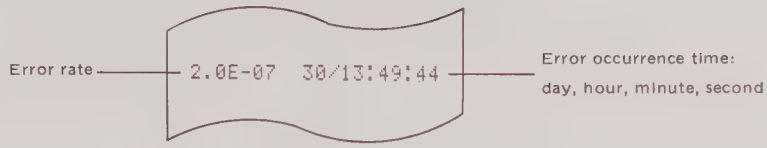
Bit 1 = 0 Bit 2 = 0

Bit 2, 3 = 1

(e) Ordinary data + threshold EI, EFI + error performance data

Fig. 3-47 Printing Format for Measurement End Data and Intermediate Data (Continued)

(iii) One second data

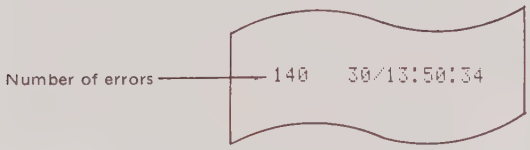


Switch settings: FUNCTION 2

Bit 3 = 1

Bit 4 to 8 = 0

(a) Error rate

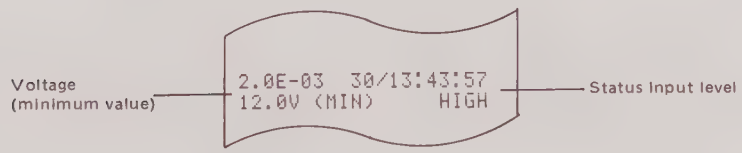


Switch settings: FUNCTION 2

Bit 3, 4 = 1

Bit 5 to 8 = 0

(b) Number of errors



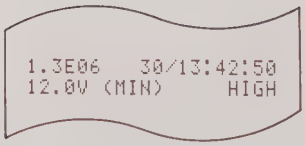
Switch settings: FUNCTION 2

Bit 3, 7 = 1

Bit 4 to 6, 8 = 0

(c) Error rate and monitor input*

Fig. 3-48 Printing Format for One Second Data



Switch settings: FUNCTION 2

Bit 3, 4, 7 = 1

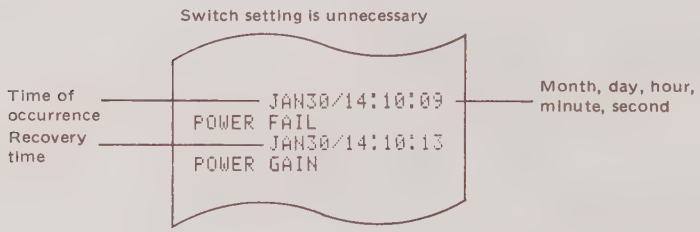
Bit 5, 6, 8 = 0

(d) Number of errors and monitor input*

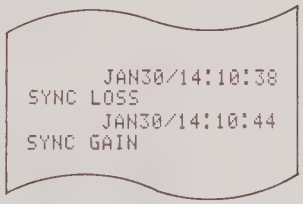
* Refer to paragraph 3.4.2 (7) (b).

Fig. 3-48 Printing Format for One Second Data (Continued)

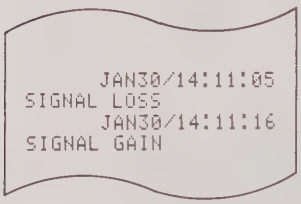
(iv) Alarm data



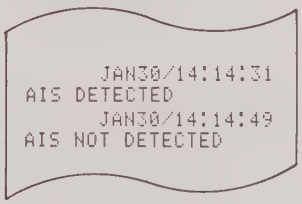
(a) POWER FAIL



(b) SYNC LOSS



(c) SIGNAL LOSS



(d) AIS

Fig. 3-49 Printing Format for Alarm Data

(7) Rear panel functions

(a) FUNCTION 1 and FUNCTION 2 switches

By setting these switches, the error interval measurement method, printing data and printing restriction can be selected.

Note:

Operation of these switches is always invalid in remote control

The function of FUNCTION 1 and FUNCTION 2 switches is shown in Table 3-7 and Table 3-8. The numbers (#1, #2, #3) in Table 3-7 and Table 3-8 are:

#1 Content related to measurement

#2 Content related to measurement end data or to printing of the measurement end data

#3 Content related to printing of one second data

FUNCTION 1 (MEASUREMENT)

ITEMS	SWITCH 0	SWITCH 1	NO.
ERROR INTERVAL	ASYNC	SYNC	1
THRESHOLD EI, EFI	OFF	ON (ASYNC)	2
ERROR PERFORMANCE	OFF	ON (ASYNC)	3
ERROR PERFORMANCE THRESHOLD	10^{-3}	10^{-4}	4
VOLTAGE	MIN	MAX	5

FUNCTION 2 (PRINTER)

ITEMS		SWITCH 0	SWITCH 1			NO.
INTERMEDIATE PRINTING		OFF	ON			1
MEASURED DATA PRINTING		ALL DATA	E. RATE E. COUNT			2
ONE SECOND DATA	PRINTING	OFF	ON			3
	DATA	E. RATE	E. COUNT			4
	THRESHOLD	E. RATE	E. COUNT	6	5	
		>10	$\geq$1	0	0	5
		$>10^{-6}$	$\geq$10	0	1	
		$>10^{-4}$	$\geq$100	1	0	6
		$>10^{-3}$	$\geq$1000	1	1	
	MONITOR INPUT	OFF	ON			7
	PAPER SAVING	OFF	ON			8

Table 3-7 FUNCTION 1

	Item	Description	Execution
1st bit #1	Selection of error interval measurement method (Note 1)	At 0: asynchronous At 1: synchronous	From next measurement
2nd bit #2	Existence of threshold EI and EFI printing (Note 2)	At 0: no printing At 1 and 1st bit is 0: printing	
3rd bit #2	Existence of error performance data printing (Note 2)	At 0: no printing At 1 and 1st bit is 0: printing The interval is fixed at 1 SEC at this time.	
4th bit #1	Selection of error performance threshold (Note 2)	At 0: 10^{-3} At 1: 10^{-4}	
5th bit #1	Minimum or maximum voltage measurement selection of monitor input voltage (Note 3)	At 0: measures minimum value At 1: measures maximum value	Without delay

Notes:

1. Refer to paragraph 3.4.2 (4) (a).
2. Refer to paragraph 3.4.2 (6) (a).
3. Refer to paragraph 3.4.2 (7) (b).

Table 3-8 FUNCTION 2

<table>
<tr><th></th><th>Item</th><th>Description</th><th>Execution</th></tr>
<tr><td>1st bit #2</td><td>Existence of intermediate printing</td><td>At 0: no printing
At 1: print out intermediate data as indicated below.
. Every two hours when the measuring time is < two days.
. Every two days when the measurement time is ≧ two days.

When the [MEAS MODE] key is set to UNTIMED, print-out is not carried out.</td><td>Without delay</td></tr>
<tr><td>2nd bit #2</td><td>Selection of print-out content of measurement end data and intermediate data</td><td>At 0: all data is printed out.
At 1: abbreviated data is printed out.</td><td></td></tr>
<tr><td>3rd bit #3</td><td>Existence of one second data printing</td><td>At 0: no printing
At 1: printing is performed.
But printing only takes place when printing conditions of the 5th and 6th bits have been satisfied.</td><td></td></tr>
<tr><td>4th bit #3</td><td>Selection of one second data print-out content</td><td>At 0: error rate
At 1: number of errors</td><td></td></tr>
<tr><td>5th & 6th bits

#3</td><td>Printing restriction of one second data</td><td>Printing takes place only when the conditions below have been satisfied.

6th bit | 5th bit | Error rate | Number of errors
0 | 0 | *>0 | ≧1
0 | 1 | $>10^{-6}$ | ≧10
1 | 0 | $>10^{-4}$ | ≧100
1 | 1 | $>10^{-3}$ | ≧1000

* Error pulse is 1 or more.</td><td></td></tr>
</table>

Table 3-8 FUNCTION 2 (Continued)

	Item	Description	Execution
7th bit #3	Existence of monitor input (voltage and status) printing (Note)	At 0: no printing At 1: printing But printing is only carried out when one second data is printed.	Without delay
8th bit #3	Printing paper saving for one second data printing	At 0: no saving At 1: saving is executed as follows . When one second data printing is continuous for 10 s, printing after this time is halted. . Release from printing shutdown is carried out when there is no demand for continuous 10 s printing.	

Note: Refer to paragraph 3.4.2 (7) (b).

(b) MONITOR INPUT

This is used when carrying out correlation measurements between external causes and error.

The monitor input (voltage and status) state is printed along with the error rate or number of errors.

The monitor input voltage can be displayed.

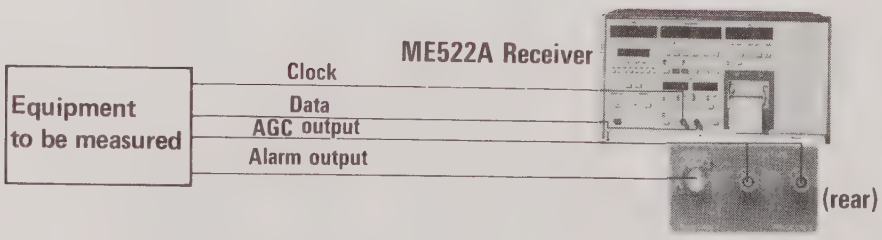


Fig. 3-50 Example of Usage

(i) STATUS

The input level (TTL) is measured at 100 ms intervals, and if a low level is detected even once during 1 s, it is regarded as low level.

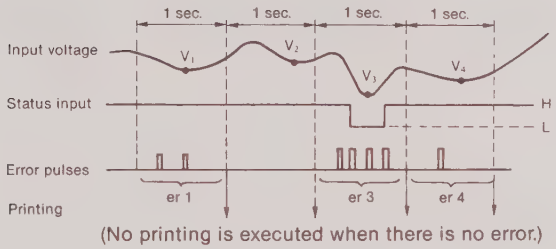


Fig. 3-51 Measurement Example

(ii) VOLTAGE

The voltage between "+" and "-" terminals is measured at each 100 ms, and the minimum value or maximum value of the measured value is calculated at each second.

(The minimum value or maximum value can be selected by the 5th bit of the FUNCTION 1 switch.)

Both the "+" terminal and the "-" terminal are floating from the cabinet ground (approx. 100 kΩ).

When the input voltage is positive, the low voltage side is connected to the "-" terminal.

When the input voltage is negative, the high voltage side is connected to the "+" terminal.

For a voltage that extends over both the positive and the negative, only one can be measured.

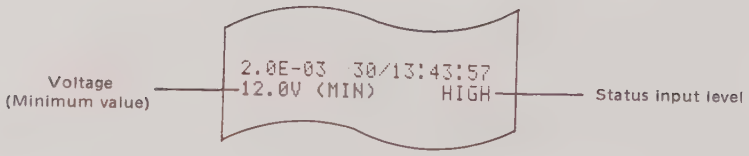


Fig. 3-52 Printing Example

(c) ALARM OUTPUT

This output is used when taking out the alarm information.

. No alarm

Both terminals are in the open status.

. Alarm (POWER FAIL, SIGNAL LOSS, SYNC LOSS, AIS)

Both terminals are short-circuited.

(Note)

When the alarm status is 1 s or less, both terminals are short-circuited for approx. 1 s.

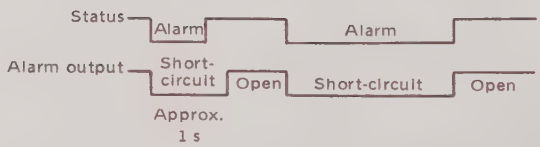


Fig. 3-53 Alarm Output

3.5 Transfer of Pattern Information

This function is used to set the receiver pattern to the programmable pattern set by the transmitter with the receiver. When the pattern length is long, this function is useful because:

- There is no need to set two times settings of the same pattern (transmitter and receiver).
- Setting errors can be avoided.

3.5.1 Preparation

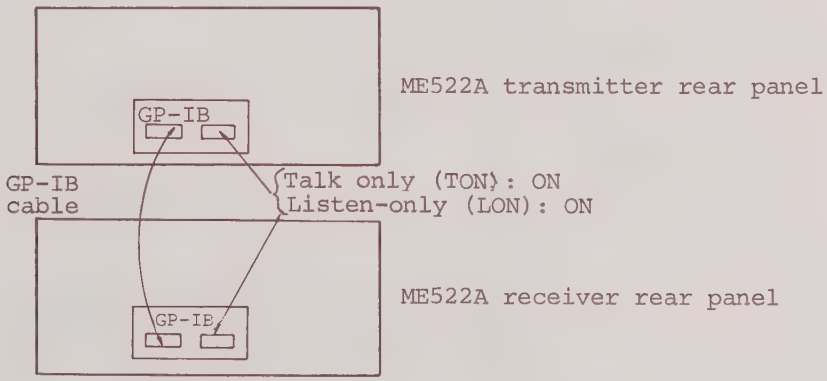
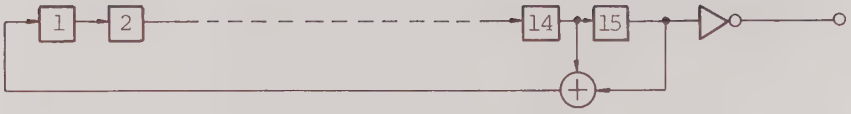


Fig. 3-54 Pattern Information Transfer Connection

1. With the transmitter and receiver POWER switches off, set both the GP-IB interface talk-only T ON switches and listen-only LON switches located on the rear panel to on.
2. Connect the transmitter GP-IB interface and the receiver GP-IB interface with the attached GP-IB cable. In this case, remove all GP-IB cables between the transmitter or receiver and other measurement instruments.



(a) Conforms to CCITT

(b) ANRITSU MEV7 compatible

Fig. 3-56 PRBS 2^{15}-1 Pattern

3.6.2 Receiver

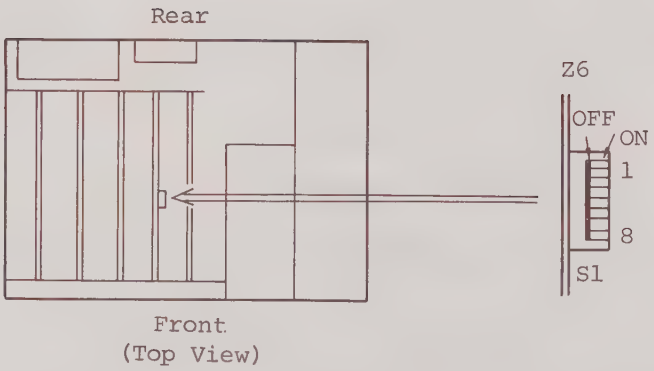


Fig. 3-57 Receiver Internal Switch Position

Table 3-10 Switch Function

No.	OFF	ON	Function	Remarks
1	Conforms to CCITT	-	PRBS $2^{15}-1$ Pattern generation method	Refer to Fig. 3-56.
2	Forward	Reverse	Printer printing direction	
3 to 8	-	-	Not used	Always leave these switches off

All switches are set to the off position at the time of shipment.

3.7 Printing Paper Replacement

A red mark on the edge of the thermal recording paper indicates that the paper is about to run out (1 m remaining). Replace the paper as follows:

Step	Procedure
1	Set the [PRINT] key #2 to OFF.
2	Push the [PRINTER EJECT] button #3 under the printer (on the receiver front panel). This releases the printer lock mechanism so that it can spring forward. Hold the front of the unit and slowly pull the printer out until it stops (halfway, approximately 100 mm).
3	Remove the remaining paper and insert a new roll. The print side is on the outside of the roll. Before loading the paper, unroll approximately 300 mm as shown in Fig. 3-58.
4	Lift level #1 and feed the recording paper through (c) and (d) shown in Fig. 3-58. If it is difficult to feed the paper through slot (c) and (d), trim the corners of the leading edge.
5	Pull the paper straight, press the level #1 down, and then press the [FEED] key #4 to feed the paper. The paper can also be fed using the feed wheel #5.
6	Gently push the printer back in until it locks.
7	To resume printing, turn the [PRINT] key #2 ON.

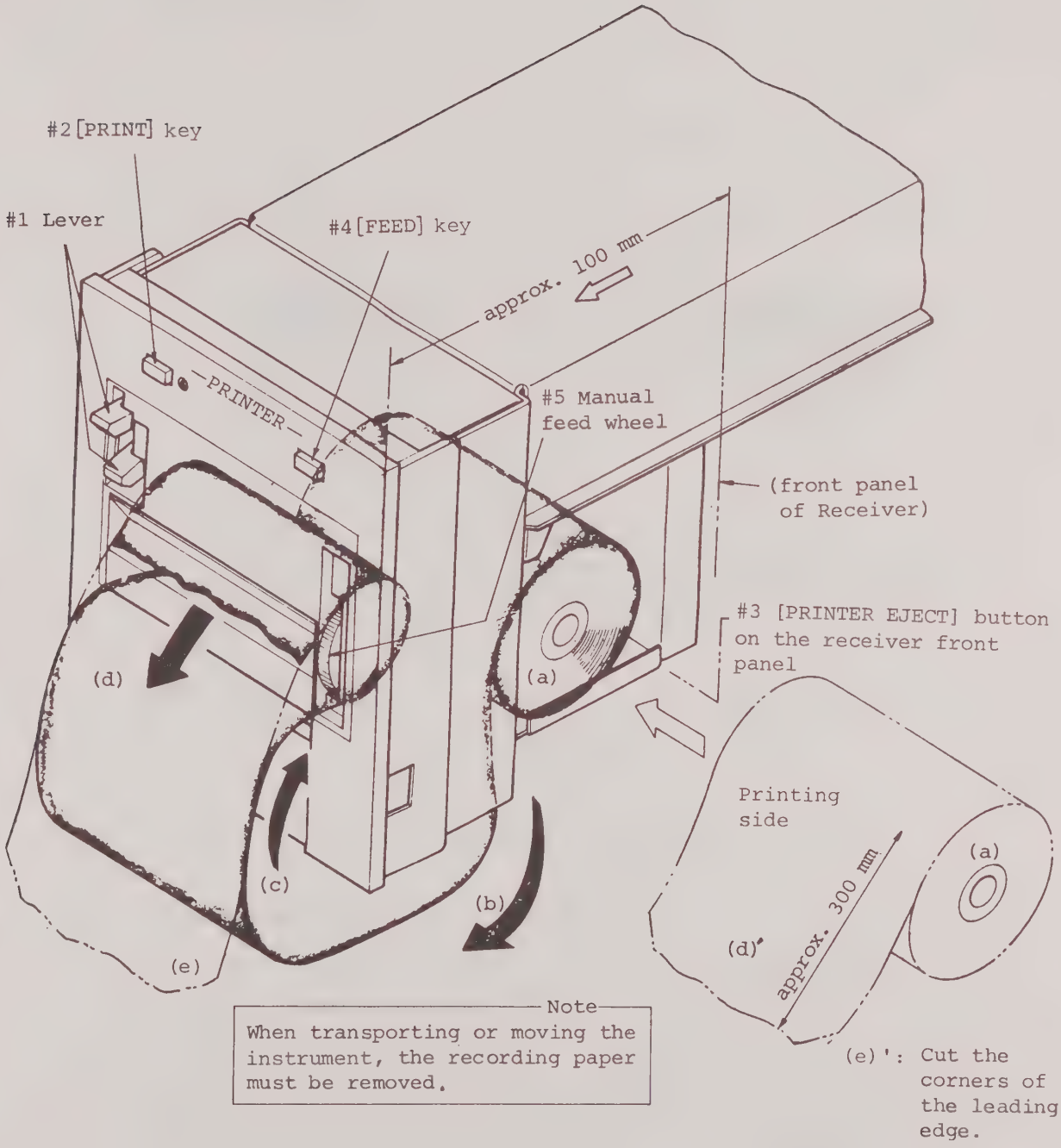


Fig. 3-58 Replacing Recording Paper

SECTION 4

MEASUREMENT

4.1 Measurement of 565 Mb/s System (140 Mb/s x 4)

An outline of this measurement is shown in Fig. 4-1.

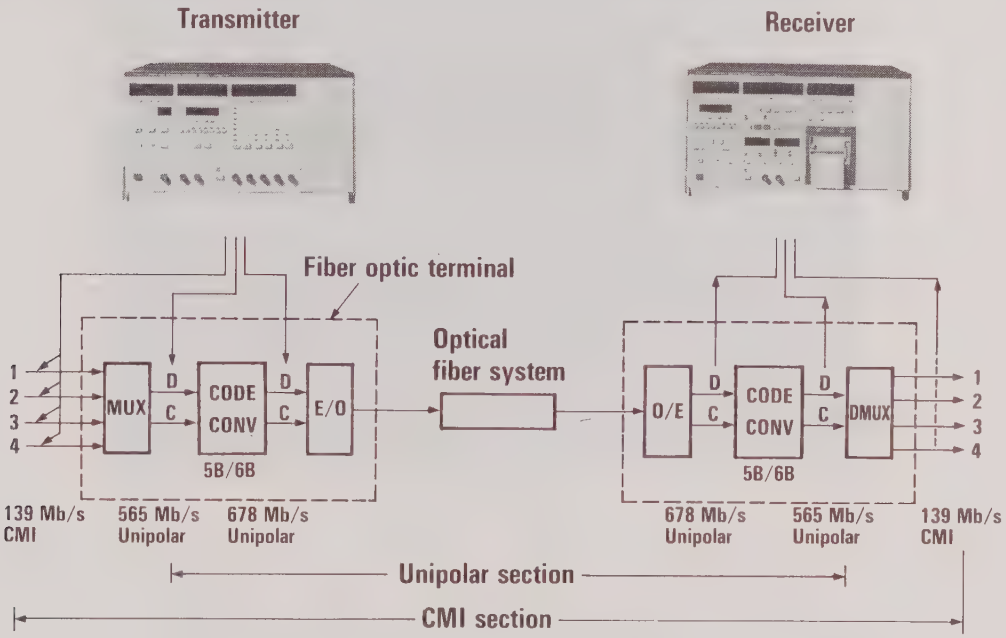


Fig. 4-1 565 Mb/s System Measurement

4.1.1 Measurement in the unipolar section

The unipolar section consists of two sections, the 565 Mb/s point and the 678 Mb/s point.

Although measurement of the 678 Mb/s point is described below, measurement of the 565 Mb/s point is the same as that for the 678 Mb/s point. Described in this manual is the equipment which uses the 5B/6B code. But when this code differs, the measurement frequency will also be different. For example, with a 7B8B code, the measurement frequency becomes:

$$564.992 \times \frac{8}{7} = 645.705 \text{ (Mb/s)}$$

(1) Panel setting

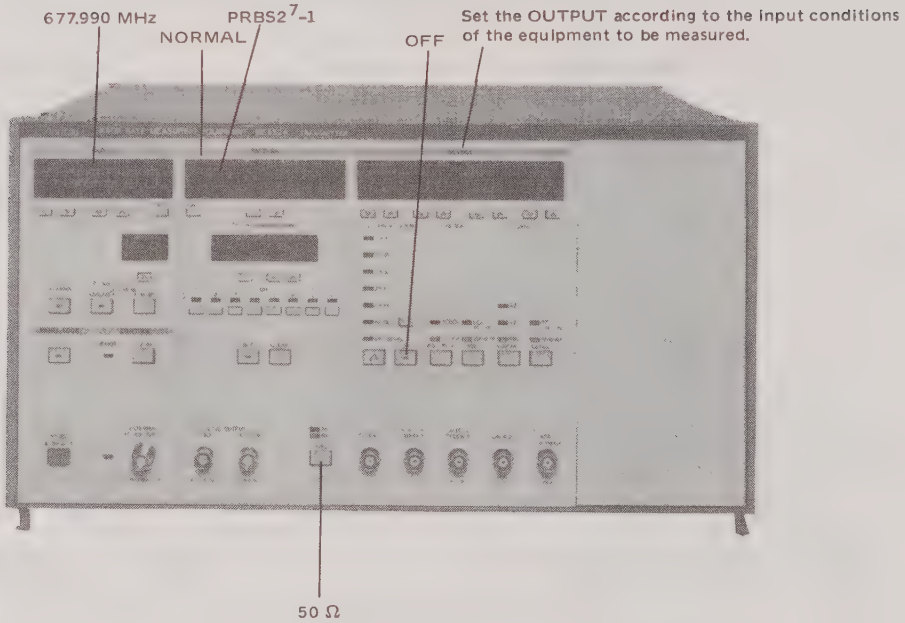


Fig. 4-2 Transmitter Settings

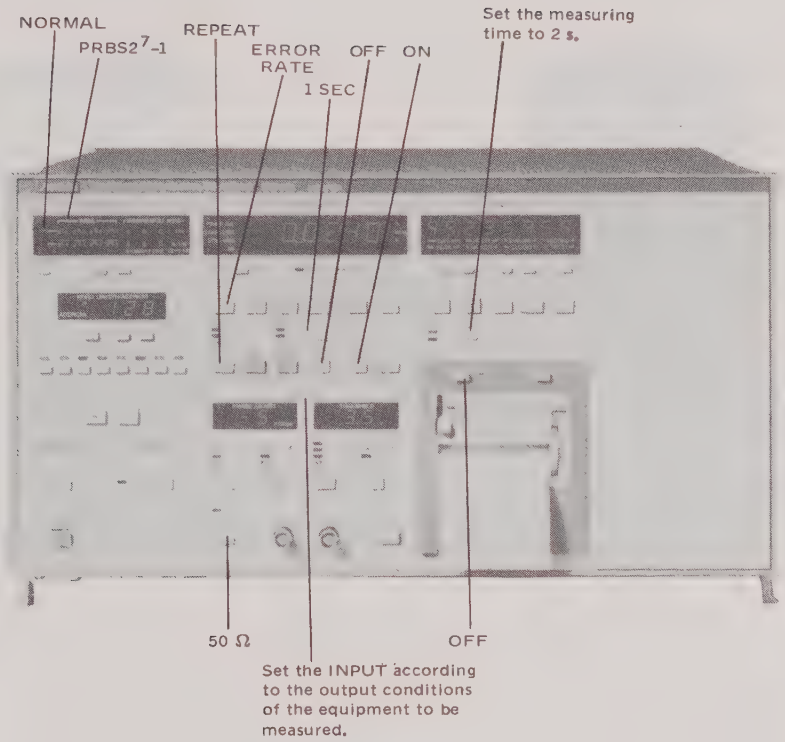


Fig. 4-3 Receiver Settings

(2) Connections

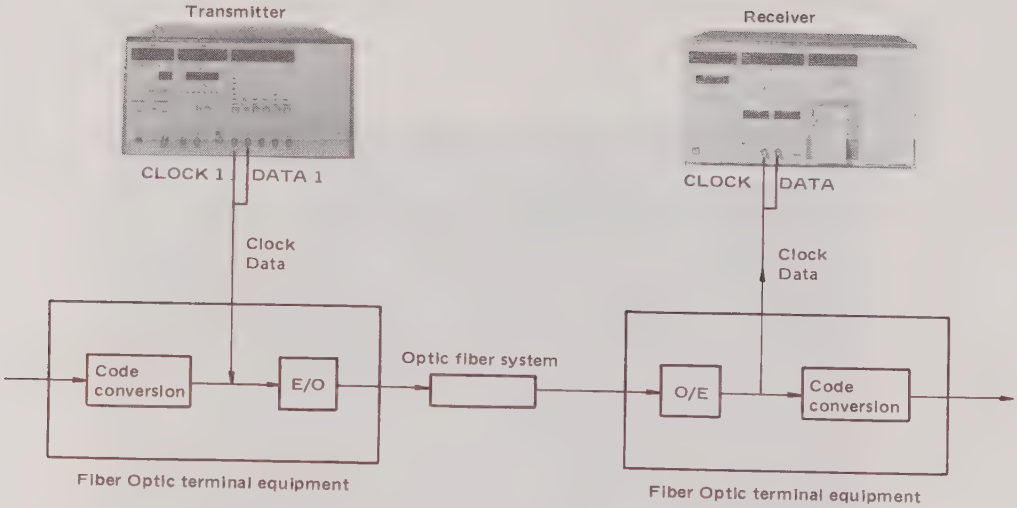


Fig. 4-4 Connection

(3) Measurement

First, verify that both the red alarm LEDs and ERRORS LED are not lit. Press the [HISTORY RESET] key in case the orange alarm LED is still lit. The lamp will go out. The measurement results will appear on the receiver display. At a measuring time of 2 s, the error rate measurement range becomes approx. 7.4 x 10^{-10} to 10^{-1}. The relation between the measuring time and the minimum error rate that can be measured is given in the following formula.

$$\text{Minimum error rate} \fallingdotseq \frac{1}{\text{Measuring time(s)} \times \text{frequency (Hz)}}$$

For example, when the minimum error rate to be measured is 10^{-12}, the measuring time is set to 30 minutes.

4.1.2 Measurement of the CMI section

(1) Panel settings

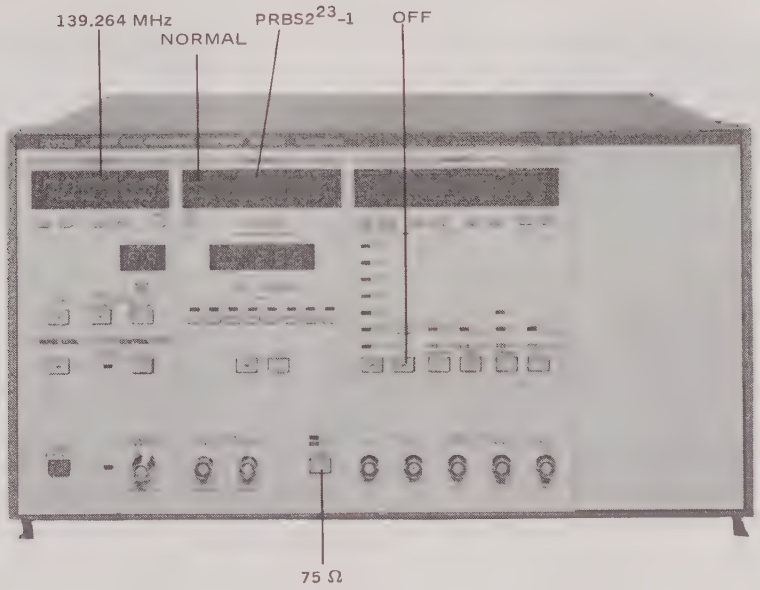


Fig. 4-5 Transmitter Settings

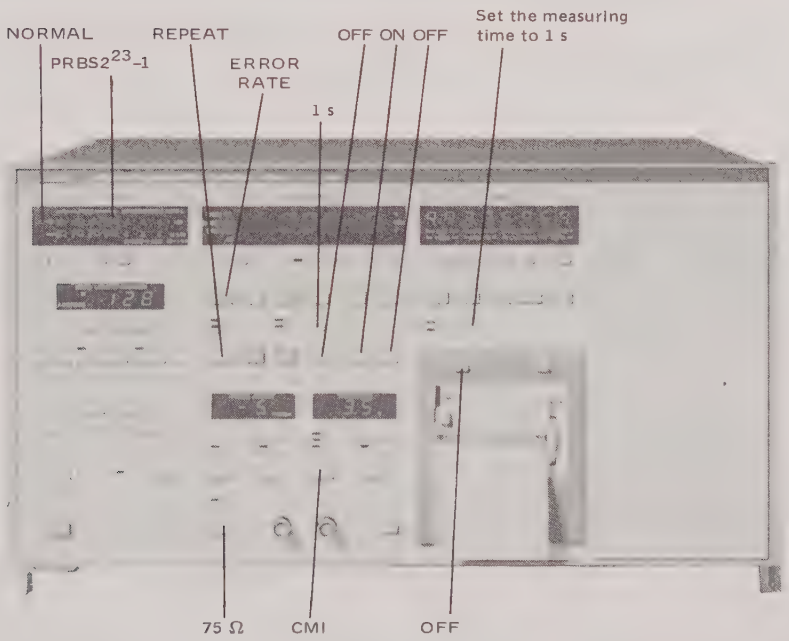


Fig. 4-6 Receiver Settings

(2) Connections

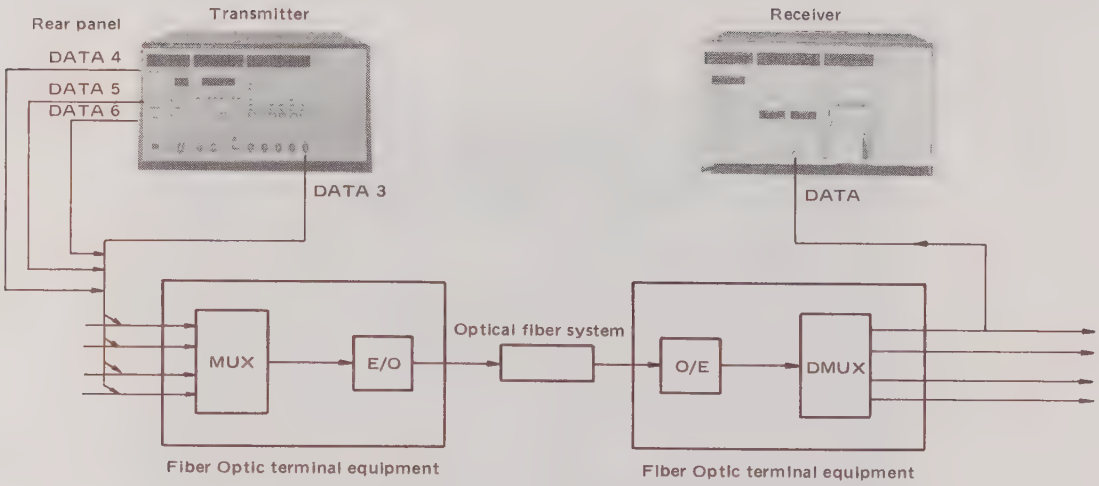


Fig. 4-7 Connections

(3) Measurement

The measurement results are displayed every second. Based on these settings, the error rate measuring range is approximately 7×10^{-9} to 1×10^{-1}.

4.2 Measurement of 565 Mb/s System (45 Mb/s X 12)

An outline of this measurement is shown in Fig. 4-8.

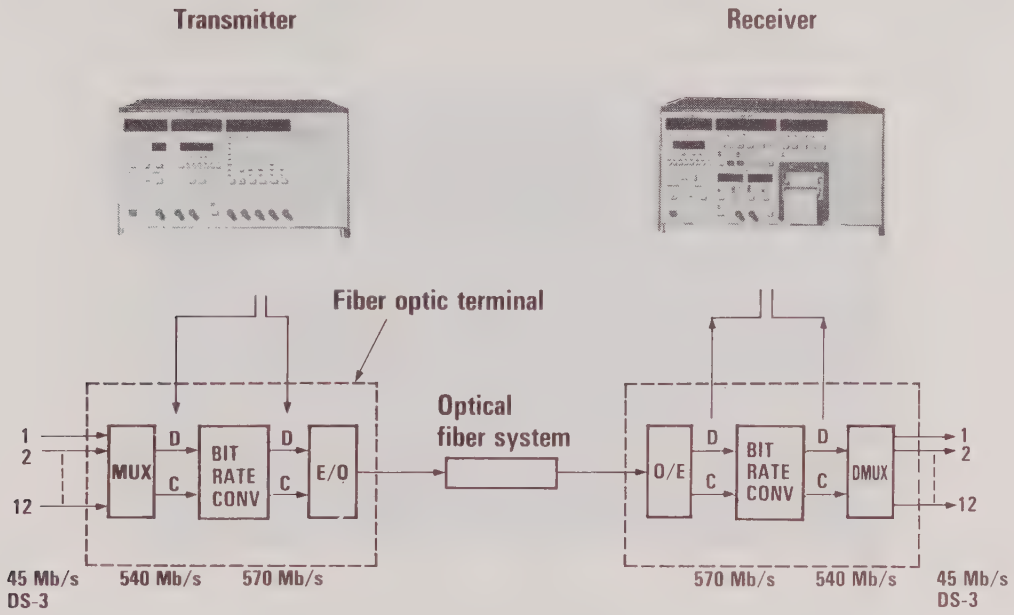


Fig. 4-8 565 Mb/s System Measurement

With this system, measurement is carried out by using the unipolar signal.

The measurement frequency will differ according to the system. The 540 Mb/s and 570 Mb/s shown in Fig. 4-8 are examples. The description that follows pertains to a measurement frequency of 570 MHz.

(1) Panel settings

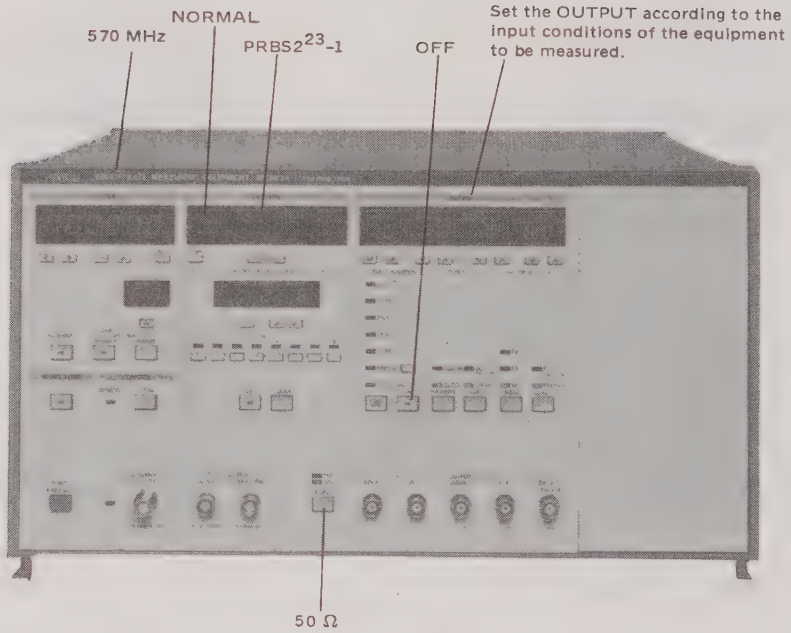


Fig. 4-9 Transmitter Settings

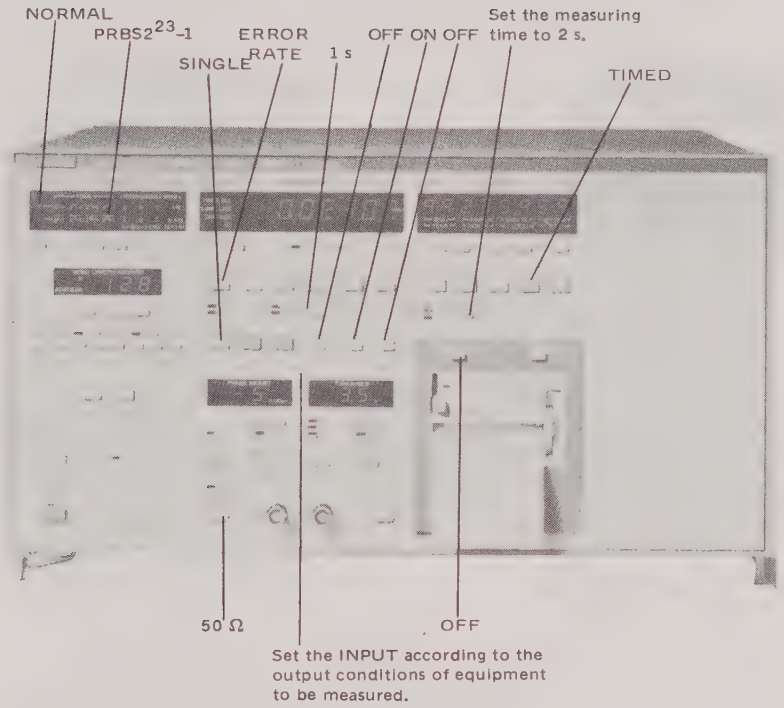


Fig. 4-10 Receiver Settings

(2) Connections

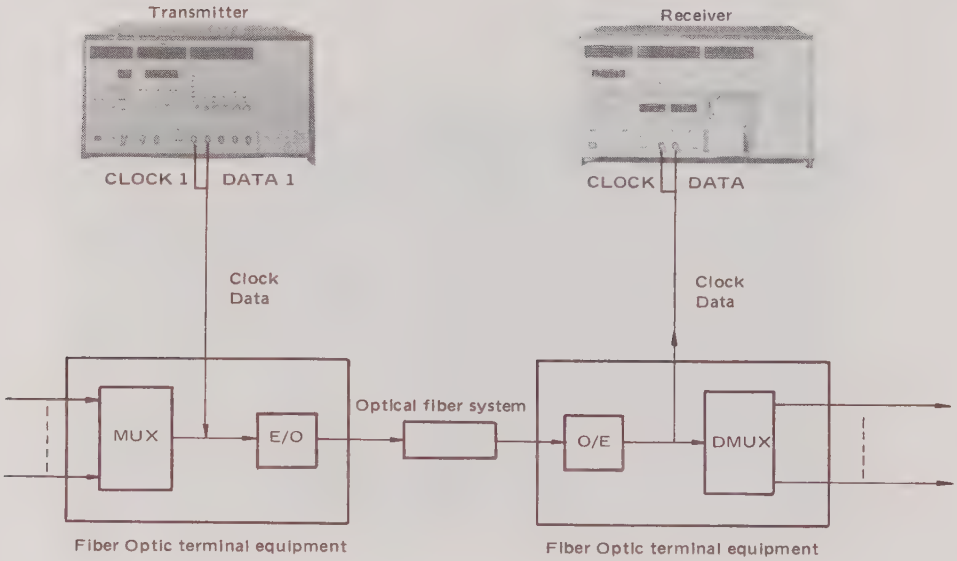


Fig. 4-11 Connections

(3) Measurement

Measurement results are displayed at 2-second intervals. Based on these settings, the error rate measuring range is approximately 8.8×10^{-10} to 1×10^{-1}.

4.3 565 Mb/s System Measurement Using Bipolar Units

An outline of this measurement is shown in Fig. 4-12.

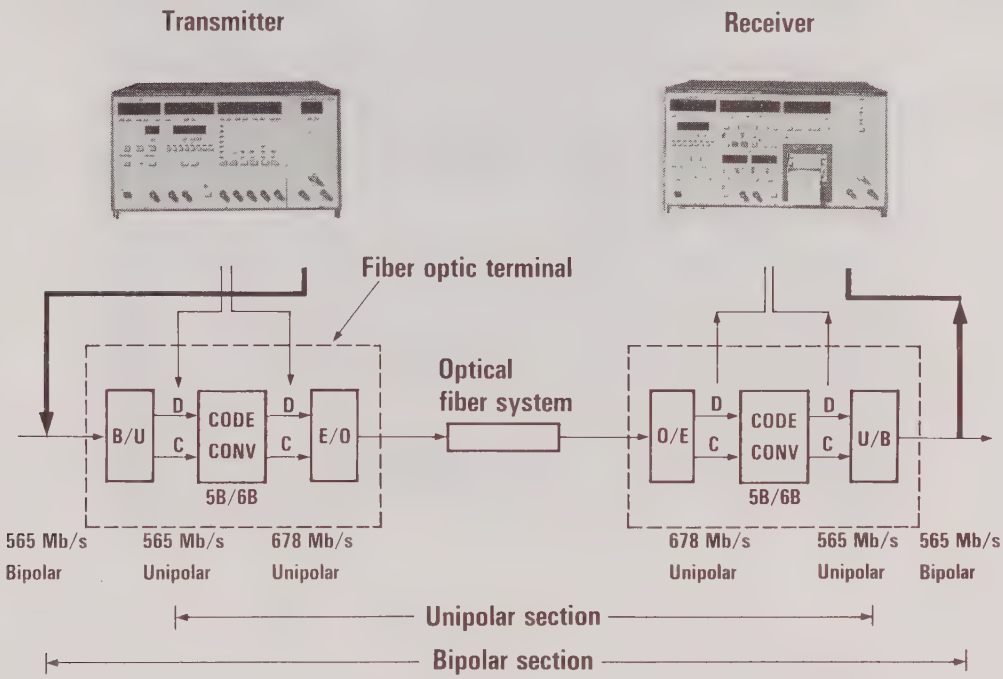


Fig. 4-12 565 Mb/s System Measurement Using Bipolar Units

This paragraph describes the measurement in the bipolar section. Refer to Paragraph 4.1 for measurement of the unipolar section.

(1) Panel settings and unit connections

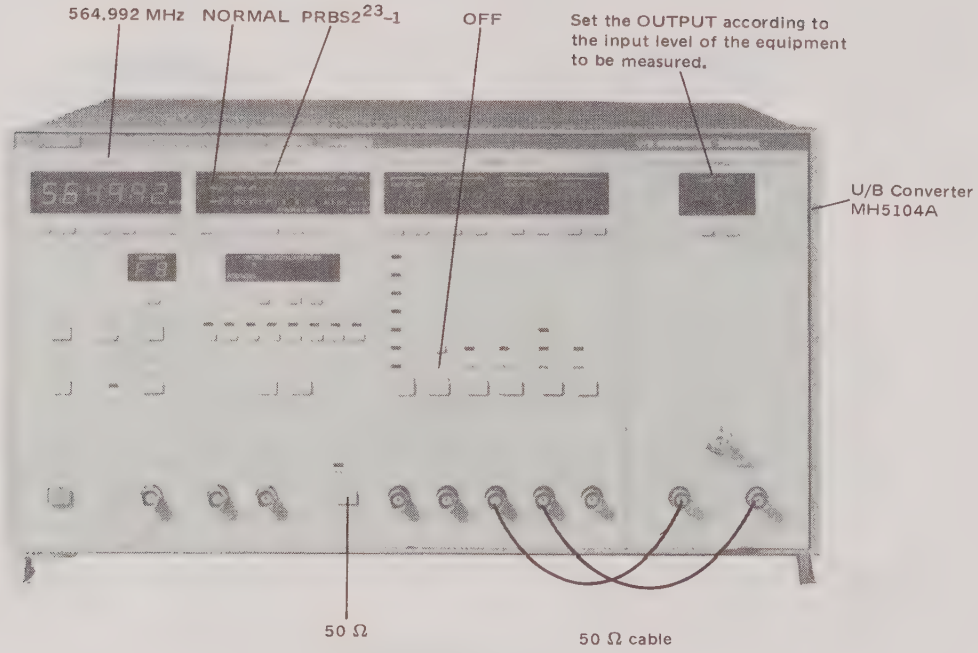


Fig. 4-13 Transmitter Setting and Unit Connections

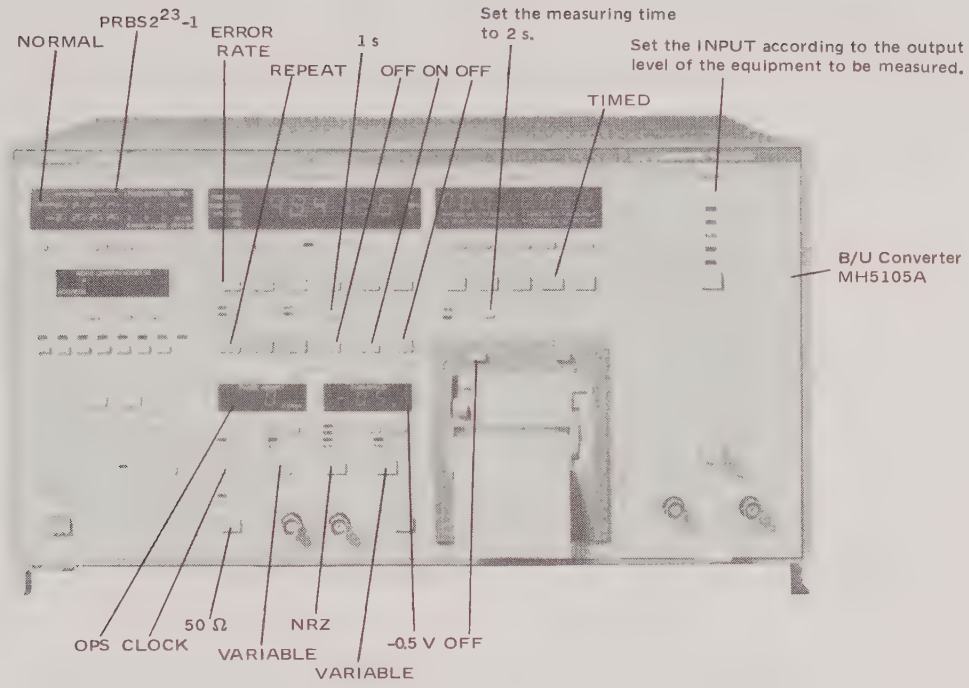


Fig. 4-14 Receiver Settings

(2) Connections

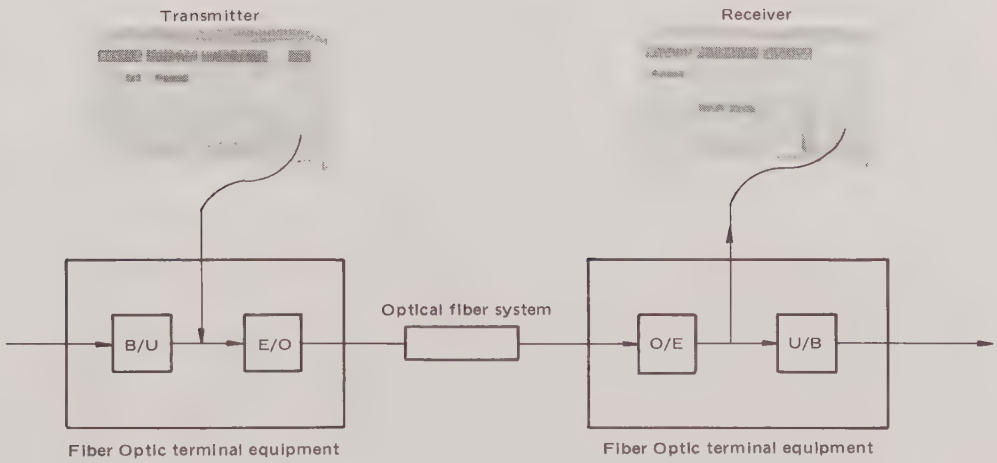


Fig. 4-15 Connections

(3) Measurement

The measurement results are displayed at 2-second intervals. Based on these settings, the error rate measurement range is approximately 8.8×10^{-10} to 1×10^{-1}.

SECTION 5

SELF TEST

As a result of direct connections between the transmitter and the receiver, the ME522A can perform self test.

5.1 Connections and Settings

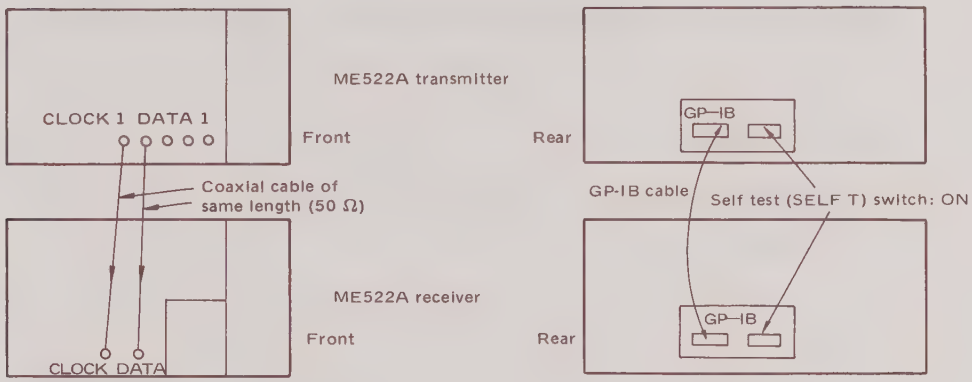


Fig. 5-1 Self Test Connections and Settings

5.2 Procedure

Step	Procedure
1	With both the transmitter and receiver POWER switches at the off position, turn on the rear panel SELF T switches of the transmitter and receiver.
2	Connect up the attached coaxial cables between the transmitter CLOCK 1 OUTPUT and the receiver CLOCK INPUT, and between the transmitter DATA 1 OUTPUT and the receiver DATA INPUT.

(Cont.)

Step	Procedure
3	Connect the transmitter GP-IB interface and the receiver GP-IB interface with the attached GP-IB cable. At this time, remove all other measuring instruments and transmitter or receiver GP-IB cables.
4	First, turn on the receiver POWER switch, and then turn on the transmitter POWER switch within 2 seconds. After the LED test has been performed, enter the self-test mode. In the absence of an abnormality, the time needed for the self test will be about 3 minutes. During self test, both the transmitter and receiver are in remote status.
5	To stop self test press the transmitter and receiver [LOCAL] keys.

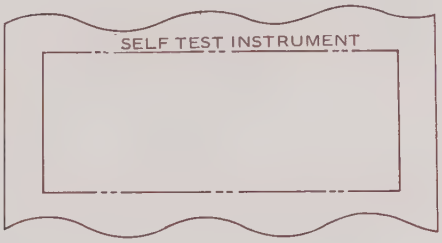
5.3 Test Item

1. Frequency
2. Patterns
3. Logic
4. Error addition (2×10^{-3} to 2×10^{-7}, single)
5. Clock polarity
6. Clock output level
7. Data waveform
8. Data output level
9. Data input threshold
10. Measurement functions (Error rate, number of errors, EI (interval: 0.01 s, 0.1 s, 1 s), EFI, frequency, voltage)

5.4 Output of Test Result

The test result is printed out by the printer built into the receiver. When no abnormality is detected, printing is done as follows.

Printing is as indicated below when an abnormality occurs in the ME522A.



The relationship between the abnormality and the printing contents appearing in the [ ] is shown below.

Printing contents	Abnormality
GP-IB	GP-IB interface
SIGNAL LOSS	Clock input/output
TRANSMITTER/RECEIVER	All frequencies and patterns
FREQUENCY	Frequency
LOGIC	Logic

(Cont.)

Printing contents	Abnormality
PRBS [ ]	PRBS pattern [ ]: abnormal pattern ([7]: 2^7-1 [10]: $2^{10}-1$ [15]: $2^{15}-1$ [23]: $2^{23}-1$)
PROG A B C 1/N	Programmable word pattern
E. AD [ ]	Error addition, or error counting [ ]: abnormal error rate [-3]: 10^{-3} [-4]: 10^{-4} [-5]: 10^{-5} [-6]: 10^{-6}
CLOCK /CLK VAR ECL	Clock polarity or clock input/output level (/CLK = $\overline{\text{CLOCK}}$)
DATA RZ /RZ VAR ECL	Data waveform or data input/output level (/RZ = $\overline{\text{RZ}}$)
ERROR RATE	Error rate measurement function
ERROR COUNT	Error count measurement function
ERROR INTERVAL	EI measurement function
ERROR INT (1S. 1S. 01S)	Error interval
ERROR FREE INTERVAL	EFI measurement function
VOLTAGE	Voltage measurement function

SECTION 6

PERFORMANCE CHECK

6.1 General

A performance check is conducted to check whether the main functions of the ME522A meet the specifications. This section gives a list of the equipment required for the performance check and explains how each test is conducted.

If the performance check results meet every specification, the ME522A is ready for normal use. If a test does not meet a specification, adjust as required according to the service manual. If the specification cannot be met after adjustments are made, contact Anritsu or representative in your area.

6.1.1 Transmitter performance check items

Table 6-1 Transmitter Performance Check Items

Paragraph	Item
6.4.1	Internal clock
6.4.2	External clock
6.4.3	PRBS pattern
6.4.4	Programmable and isolated patterns
6.4.5	Alternate pattern
6.4.6	Error addition
6.4.7	CLOCK 1 and DATA 1 outputs
6.4.8	CLOCK 2 and DATA 2 outputs
6.4.9	Load
6.4.10	DATA 3 to DATA 6 outputs
6.4.11	Gate signal input

6.1.2 Receiver performance check items

Table 6-2 Receiver Performance Check Items

Paragraph	Item
6.5.1	Unipolar input
6.5.2	CMI input
6.5.3	Pattern
6.5.4	Measurement function
6.5.5	Alarm output
6.5.6	Printer

6.2 Equipment Required for Performance Check

Tables 6-3 and 6-4 give the list of the equipment required for the performance check, their performance requirements and related paragraphs.

Table 6-3 Equipment Required for Performance Check (Transmitter)

Equipment	Specifications	Application (Paragraph)
Frequency counter MF63A	Frequency range: 1 MHz to 700 MHz Resolution: 100 Hz Stability: $\leqq 1 \times 10^{-8}$/day	6.4.1 6.4.2
Synthesized signal generator MG655A	Frequency range: 1 MHz to 700 MHz Resolution: 1 kHz	6.4.2
Pulse generator MG418A or function generator	Frequency range: 10 Hz to 50 MHz Level: TTL, 0/-1 V	6.4.2, 6.4.11 6.4.5, 6.4.6
Sampling oscilloscope	Frequency range: dc to 10 GHz, 2CH	6.4.2, 6.4.8 6.4.4, 6.4.9 6.4.5, 6.4.10 6.4.7, 6.4.11

Table 6-3 Equipment Required for Performance Check (Transmitter) (Continued)

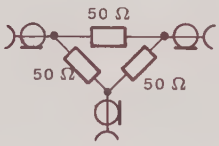
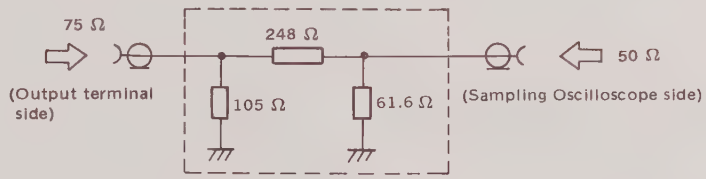
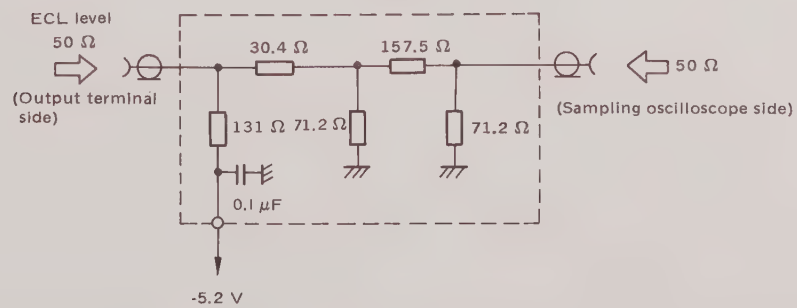
Equipment	Specifications	Application (Paragraph)
Universal counter	Frequency range: dc to 500 MHz Input sensitivity: 300 mV 2CH, with operational function	6.4.3 6.4.6
Stable dc power supply	-5.2 Vdc, ≧50 mA	
Three SMA connectors with 20 dB pad	Impedance: 50 Ω	6.4.7, 6.4.8 6.4.9, 6.4.10
Two BNC-P.SMA-J conversion connectors	Impedance: 50 Ω	
6 dB power divider	Frequency range: dc to 2 GHz	6.4.2, 6.4.5
		
50 Ω - 75 Ω impedance transformer MP614A	Frequency range: 1 MHz to 1 GHz Insertion loss: ≦2 dB	6.4.2
75 Ω/50 Ω impedance converter MP667A	Frequency range: dc to 2 GHz I/O voltage ratio: 1/10 (-20 dB)	6.4.9, 6.4.10
		
ECL level converter MP668A	Frequency range: dc to 2 GHz I/O voltage ratio: 1/10 (-20 dB)	6.4.7
		

Table 6-4 Equipment Required for Performance Check (Receiver)

Equipment	Specifications	Application (Paragraph)
ME522A transmitter	See Table 2-6	6.5.1, 6.5.2 6.5.3, 6.5.4 6.5.5, 6.5.6
Power supply	Voltage: 0 to 20 V	6.5.4
Multimeter	Voltage and resistance measurements	6.5.5

6.3 Preparations

1. Initialize the ME522A.
2. Warm up the ME522A and all measuring equipment at least 30 minutes.

6.4 Transmitter Performance Check Procedure

6.4.1 Internal clock

(1) Specifications

Frequency range: 1.000 MHz to 700.000 MHz
in steps of 1 kHz

Accuracy : Within $\pm 2 \times 10^{-6}$.
After 30 minutes operation

(2) Setup

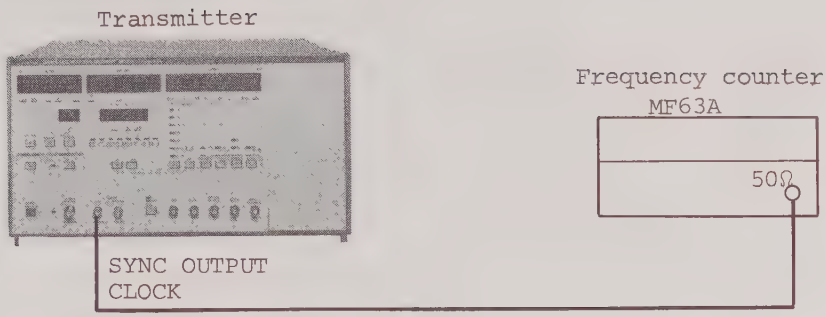


Fig. 6-1 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-1.
2	Press the CLOCK to INTERNAL [MEMORY] key.
3	Press the MEMORY [⩓] key and read the MF63A idication each time the key is pressed.
4	Confirm that the read values are within the ±2 ppm range of the displayed values of the transmitter CLOCK display.
	Note:
	The set frequencies for the memory numbers are as follows.

(Cont.)

Step	Procedure

Memory number	Set frequency (MHz)	Output frequency tolerable range (MHz)
F1	1.000	0.999998 to 1.000002
F2	10.000	9.99998 to 10.00002
F3	100.000	99.9998 to 100.0002
F4	200.000	199.9996 to 200.0004
F5	300.000	299.9994 to 300.0006
F6	400.000	399.9992 to 400.0008
F7	500.000	499.9990 to 500.0010
F8	600.000	599.9988 to 600.0012
F9	700.000	699.9986 to 700.0014

5 Set the memory number to F9 and press the [SET] key. The 1 MHz digit of the CLOCK display value will blink.

6 Move the blinking digit to the 1 kHz digit with the [≫] key.

7 Decrease the frequency in 1 kHz steps with the [⩒] key. Confirm that the frequency counter display varies in 1 kHz steps.

6.4.2 External clock

(1) Specifications

Frequency: 1 MHz to 700 MHz

Input level: 0.8 to 1.2 Vp-p

Input waveform: 1 MHz to 10 MHz: Rectangular waves
10 MHz to 700 MHz: Sinusoidal or rectangular waves

(2) Setup

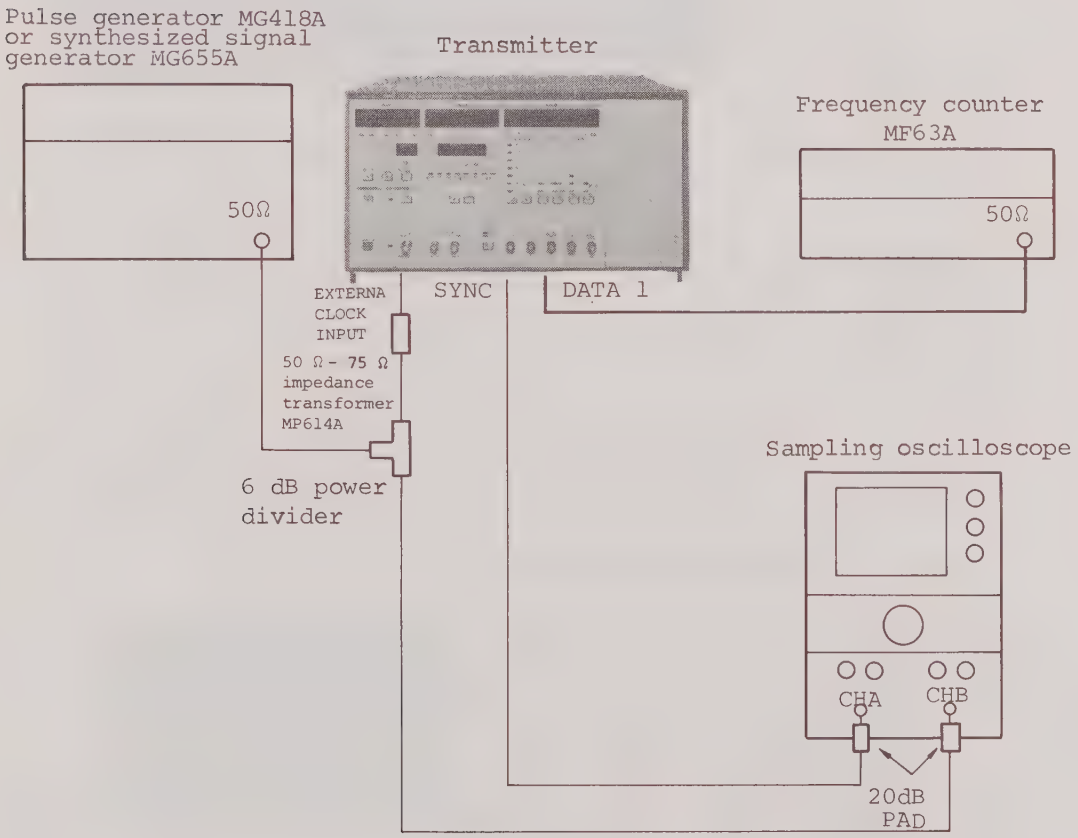
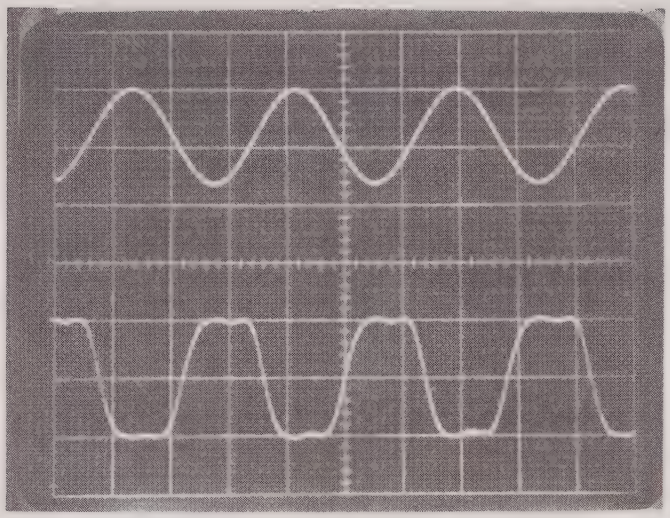


Fig. 6-2 Setup Use 50 Ω Cables

(3) Procedure

Step	Procedure
1	Setup as shown in Fig. 6-2.
2	Set the transmitter as follows. CLOCK: EXTERNAL CLOCK 1 POLARITY: CLOCK CLOCK 1 LEVEL: VARIABLE CLOCK 1 AMPLITUDE: 1.0 V CLOCK 1 OFFSET: 0.0 V LOAD: 50 Ω
3	Set the sampling oscilloscope trigger mode to internal, CH2. The amplitude of the clock signal applied to the EXTERNAL CLOCK INPUT connector of the transmitter can be directly read from the CH2 level on the oscilloscope.
4	Set the output frequency and output level of the pulse generator or synthesized signal generator to the upper and lower specifications in paragraph 6.4.2 (1), and check the following two points. 1. Does the displayed value (clock frequency) of the frequency counter coincide with the output frequency of the pulse generator or synthesized signal generator? 2. Is the CLOCK 1 output waveform of CH1 on the oscilloscope normal? See Fig. 6-3.



CHB: External clock input

CHA: CLOCK 1 OUTPUT

500 ps/div
0.5 V/div

Fig. 6-3 CLOCK 1 Output Waveform

6.4.3 PRBS pattern

(1) Specifications

7 stages, 10 stages, 15 stages*, 23 stages*
(* According to CCITT Rec. O.151)

(2) Setup

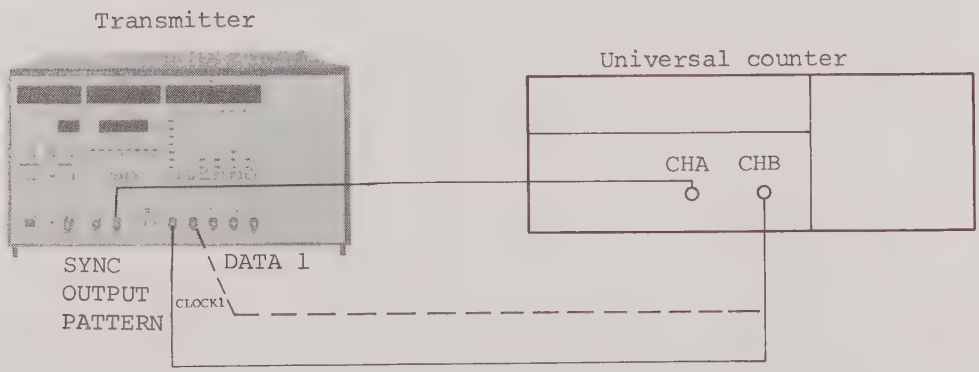


Fig. 6-4 Setup Use 50 Ω Cables

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-4. Connect the universal counter CHB to CLOCK 1.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: PRBS 2^7-1 ERROR ADDITION: OFF CLOCK 1 POLARITY: CLOCK CLOCK 1 LEVEL: VARIABLE, amplitude 1 V, offset 0 V DATA 1 FORMAT: NRZ DATA 1 LEVEL: VARIABLE, amplitude 1 V, offset 0 V LOAD: 50 Ω
3	Set the universal counter function switch to "B/A ratio" and the resolution switch to "10" (0.1 MHz)
4	Change the PRBS pattern in the order 2^7-1, 2^{10}-1, 2^{15}-1 and 2^{23}-1, and confirm that the displayed values on the universal counter are the same as those shown in Table 6-5.

Table 6-5 Number of Clock Pulses

PRBS pattern	Universal counter display value
2^7-1	1016 ±1
2^{10}-1	8184 ±1
2^{15}-1	262136 ±1
2^{23}-1	67108856 ±1

(Cont.)

Step	Procedure
5	Disconnect the cable between CLOCK 1 and the universal counter CHB and connect the DATA 1 to the universal counter CHB.
6	Change the PRBS pattern in the order 2^7-1, 2^{10}-1, 2^{15}-1 and 2^{23}-1, and confirm that the displayed values on the universal counter are the same as those shown in Table 6-6.

Table 6-6 Number of "1"s in the PRBS Data

PRBS pattern	Universal counter display value
2^7-1	256 ±1
2^{10}-1	2048 ±1
2^{15}-1	65536 ±1
2^{23}-1	16777216 ±1

6.4.4 Programmable and isolated patterns

(1) Specification

Programmable pattern:

3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits. When the intial switch is set, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C automatically.

Isolated pattern:

1/1 to 1/64 (1/m: one mark ("1") in a pattern of m bits)

(2) Setup

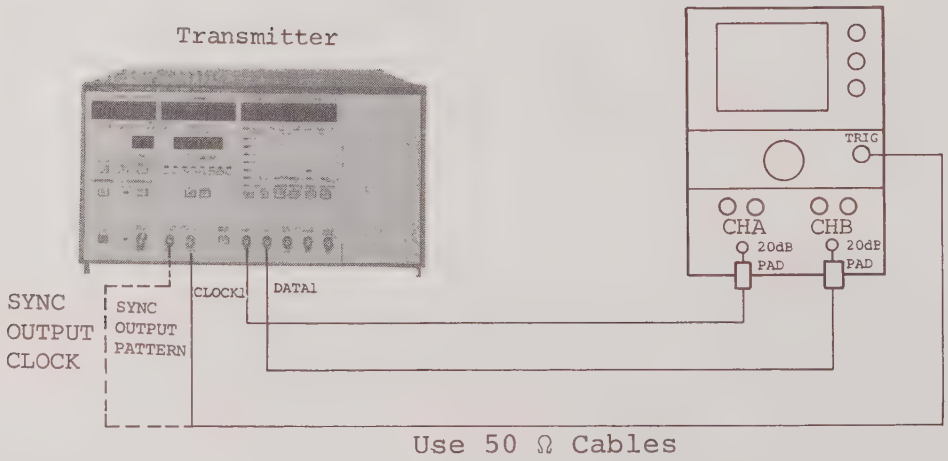


Fig. 6-5 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-5.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: Set to the pattern to be checked. . For programmable patterns A, B or C . For isolated pattern 1/N . For mark ratio variable pattern Mark ratio 1/2: A Mark ratio 1/4: B Mark ratio 1/8: C ERROR ADDITION: OFF CLOCK 1 POLARITY: CLOCK CLOCK 1 LEVEL: VARIABLE AMPLITUDE 1 V, OFFSET 1 V DATA 1 FORMAT: NRZ DATA 1 LEVEL: VARIABLE AMPLITUDE 1 V, OFF SET 1 V LOAD: 50 Ω

(Cont.)

Step	Procedure
3	Set the patterns with the PROGRAMMABLE WORD keys.
	(a) For setting 10011000 01111100 to A as programmable patterns.
	1 Set the pattern to A.
	2 Set N to 2.
	3 Set ADDRESS to 1 and write 10011000 in the 8 bits of ADDRESS 1 using the [BIT] keys and [SET] key.
	4 Next, write 01111100 in the 8 bits of ADDRESS 2.
	(b) For setting 1/20 pattern as an isolated pattern
	1 Set the pattern to 1/N
	2 Set N to 20.
4	Confirm that the waveform on the sampling oscilloscope agree with the following waveforms.

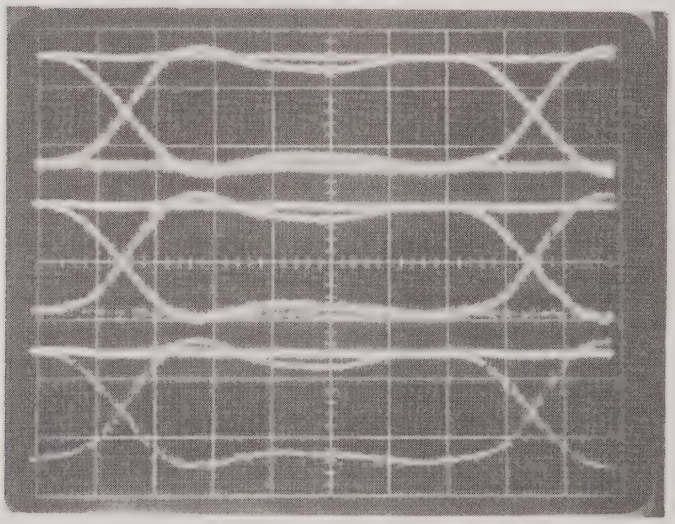
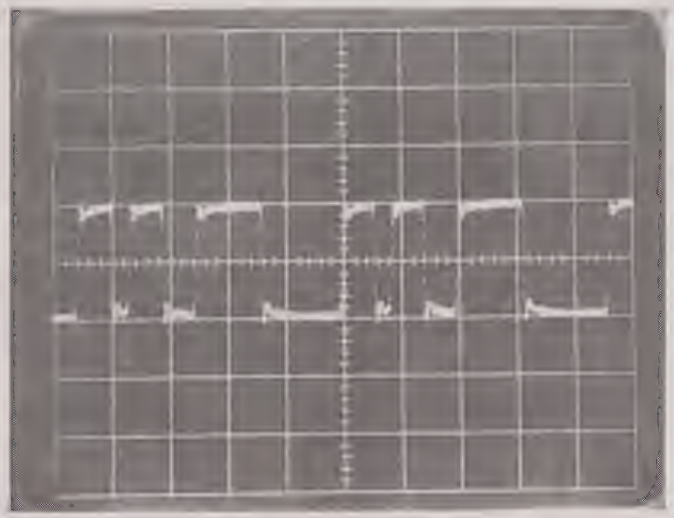
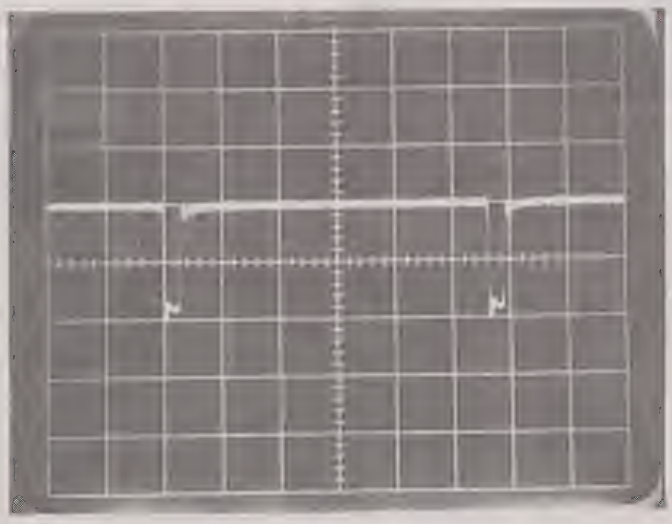


Fig. 6-6 Mark Ratio Variable Pattern



5 ns/div
0.5 V/div

Fig. 6-7 Programmable Pattern



5 ns/div
0.5 V/div

Fig. 6-8 Isolated Pattern (1/20)

4 (cont.) For the mark ratio variable pattern, connect the sampling oscilloscope trigger input connector (TRIG) to the SYNC OUTPUT CLOCK connector.

6.4.5 Alternate pattern

(1) Specifications

Alternate pattern:

8-bit programmable patterns D and E

Alternate signal input

Operation frequency: DC to 5 MHz

Level, connector: TTL

(Low: Output of pattern D;
High: Output of pattern E),
BNC

(2) Setup

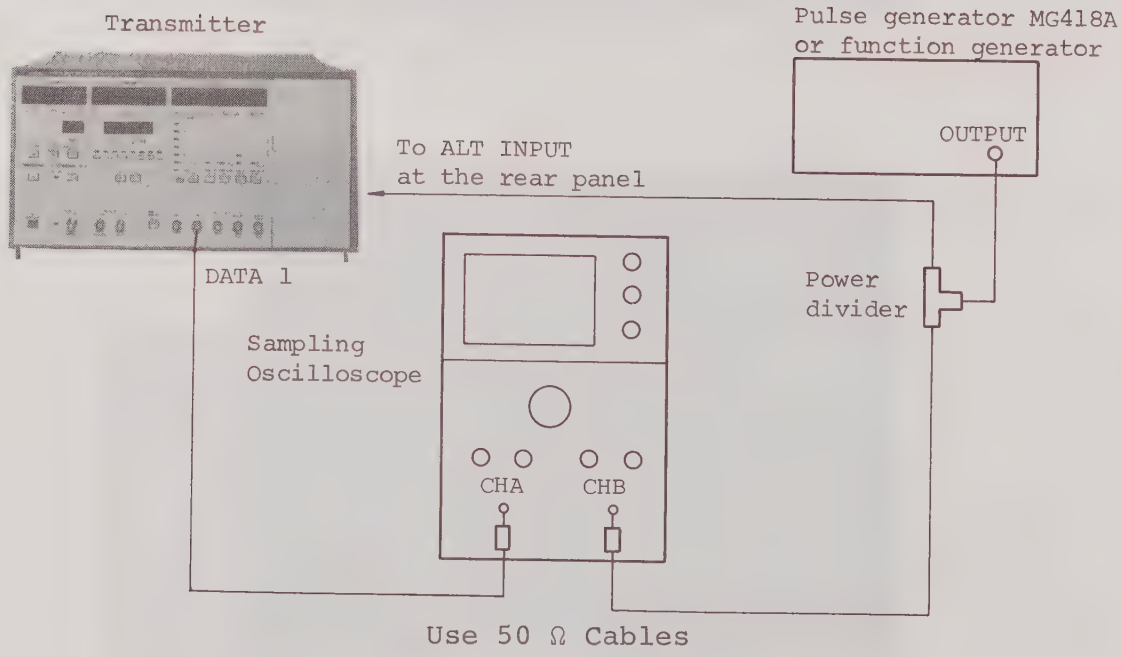


Fig. 6-9 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-9.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: PROGRAMMABLE WORD ALT D/E ERROR ADDITION: OFF DATA 1 FORMAT: NRZ DATA 1 LEVEL: VARIABLE AMPLITUDE 1 V, OFFSET 1 V LOAD: 50 Ω
3	Apply a 5 MHz TTL level rectangular wave to ALT INPUT from the pulse generator or function generator.
4	Set "00000000" to ADDRESS D.
5	Set "11111111" to ADDRESS E.
6	Confirm that the waveforms on the sampling oscilloscope coincide with the alternate patterns shown in Fig. 6-10.

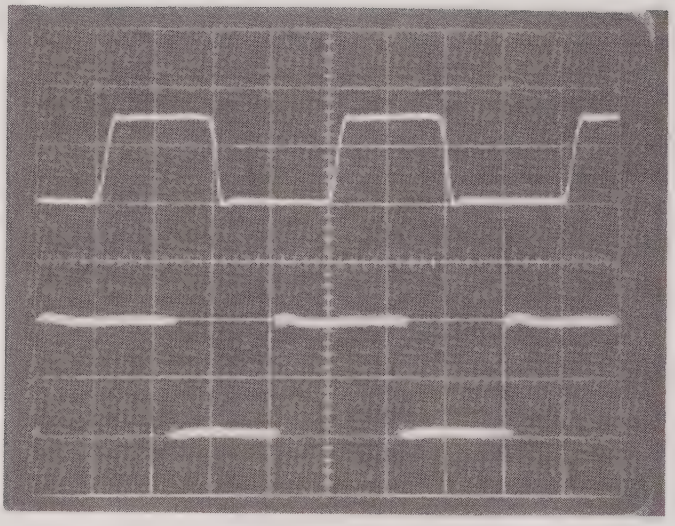


Fig. 6-10 Alternate Pattern

6.4.6 Error addition

(1) Specification

Error — Bit error

Internal — Ratio: $2x10^{-3}$, $2x10^{-4}$, $2x10^{-5}$, $2x10^{-6}$, $2x10^{-7}$, single

External input

Operation frequency: DC to 1/40 of the clock frequency

Level: TTL

Connector: BNC

(2) Setup

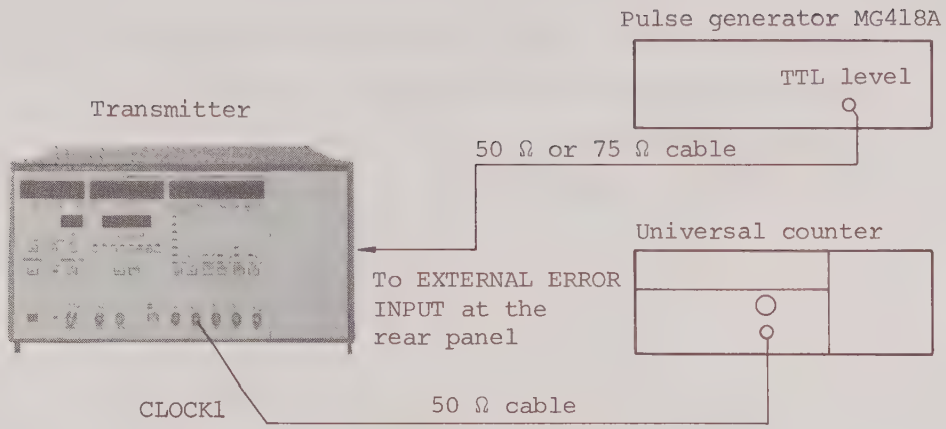


Fig. 6-11 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-11.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: A ERROR ADDITION: ON DATA 1 FORMAT: NRZ DATA 1 LEVEL: VARIABLE AMPLITUDE 1 V, OFFSET 1 V
3	Set N to 1 with the PROGRAMMABLE WORD keys, and write zeros for all of the 8 bits of ADDRESS 1.

(Cont.)

Step	Procedure

4 Check according to the following procedures depending on the error addition method.

(a) Single error

1 Set ERROR ADDITION to SINGLE.

2 Set the universal counter to pulse count mode, and press the reset switch.

3 Confirm that when the [SINGLE] key is pressed once, the universal counter displays 1, then 2, 3, ... n when the key is pressed two, three ... n times.

(b) Addition by specifying the error rate

1 Set the universal counter to the frequency measurement mode and the frequency resolution to the 10 Hz range.

2 Set the ERROR ADDITION to 2×10^{-7}, 2×10^{-6}, 2×10^{-5}, 2×10^{-4}, and 2×10^{-3} with the [⩓] key and confirm that the display for each setting coincides with the value shown in Table 6-7.

Table 6-7 Error Addition by Specifying the Error Rate

Set value	Counter display value (Hz)
2×10^{-7}	140 ±1
2×10^{-6}	1400 ±1
2×10^{-5}	14000 ±1
2×10^{-4}	140000 ±1
2×10^{-3}	1400000 ±1

(Cont.)

Step	Procedure
	(c) Addition by external input
	1 Generate the 17.5 MHz, TTL level signal from the pulse generator or function generator and apply it to the rear panel EXTERNAL ERROR INPUT connector.
	2 Set the universal counter to the frequency measurement mode.
	3 Confirm that the counter display value agrees with the pulse generator repeating frequency.

6.4.7 CLOCK 1 and DATA 1 outputs

(1) Specifications

Operation frequency:

1 MHz to 700 MHz

Waveform:

Clock: RZ* (*Duty: Within 45 to 55% with internal clock)

Data: NRZ, RZ*, $\overline{RZ*}$

Amplitude:

1 to 3 V in steps of 0.05 V
(However, display is made in steps of 0.1 V)
Also, ECL.
(ECL: when connected to -2 V via 50 Ω or 75 Ω)

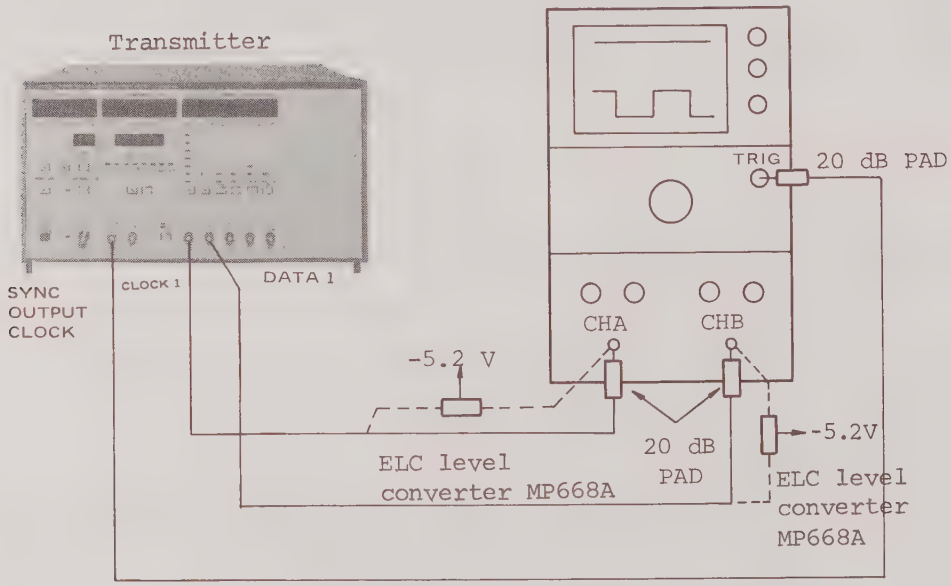
Offset:

-1 to +4 V in steps of 0.05 V.
(However, display is made in steps of 0.1 V)
Also ECL.
(ECL: when connected to -2 V via 50 Ω or 75 Ω)

Level accuracy:

Voltage and offset within the larger one of set value ±10% or ±0.15 V

(2) Setup



Use 50 Ω cables

Fig. 6-12 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-12.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F1 (1.000 MHz) to F9 (700.000 MHz) PATTERN: PRBS $2^{23}-1$ ERROR ADDITION: OFF LOAD: 50 Ω CLOCK 1: LEVEL VARIABLE AMPLITUDE 3.0 V, OFFSET 0 V DATA 1: LEVEL VARIABLE AMPLITUDE 3.0 V, OFFSET 0 V

. CLOCK 1 output waveform check

3 Set to CLOCK or $\overline{\text{CLOCK}}$ with the CLOCK 1 [POLARITY] key, and confirm that the waveform is as shown in Fig. 6-13.

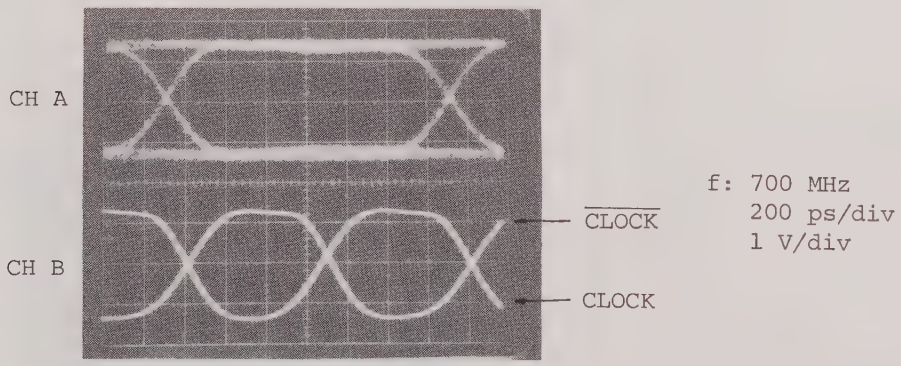


Fig. 6-13 COCK 1 Output Waveform

(Cont.)

Step	Procedure

. DATA 1 output waveform check

4 Set to NRZ, RZ and $\overline{RZ}$ with the DATA 1 [FORMAT] key, and confirm that the waveform is as shown in Fig. 6-14.

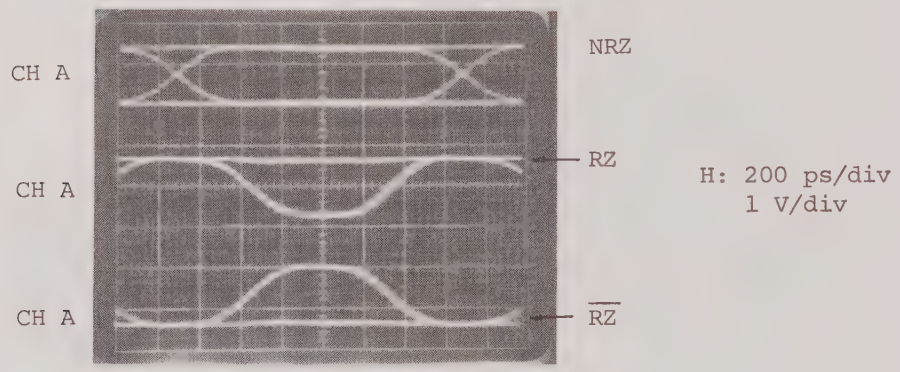


Fig. 6-14 DATA 1 Output Format

. CLOCK 1 output and DATA 1 output amplitude checks

5 Confirm that the CLOCK 1 and DATA 1 amplitude can vary from 1 V to 3 V by the respective CLOCK 1 and DATA 1 AMPLITUDE [⩒], [⩓] keys. (See Fig. 6-15.)
Keep the DATA 1 output format in RZ.

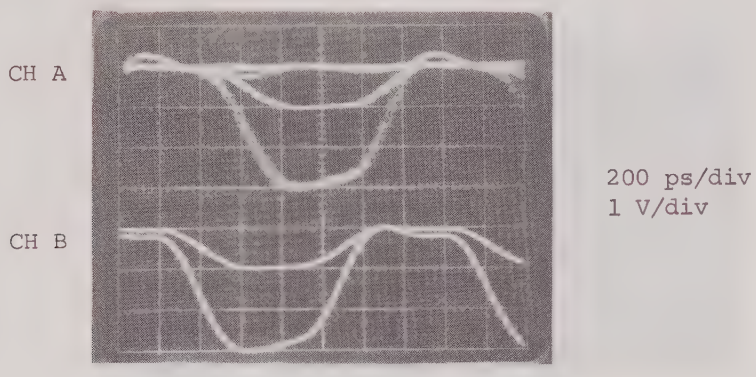


Fig. 6-15 CLOCK 1 Output and DATA 1 Output Amplitude

. CLOCK 1 output and DATA 1 output offset voltage checks

6 Confirm that the CLOCK 1 and DATA 1 offset voltage can vary from -1 to -4 V by the respective CLOCK 1 and DATA 1 OFFSET [⩒], [⩓] keys. See Fig. 6-16 for the CLOCK 1 output offset check and Fig. 6-17 for the DATA 1 output offset check. Keep the DATA 1 output format in NRZ.

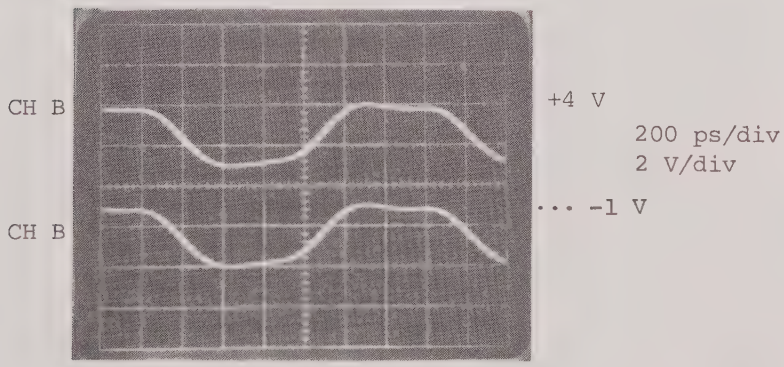


Fig. 6-16 CLOCK 1 Output Offset

Step	Procedure

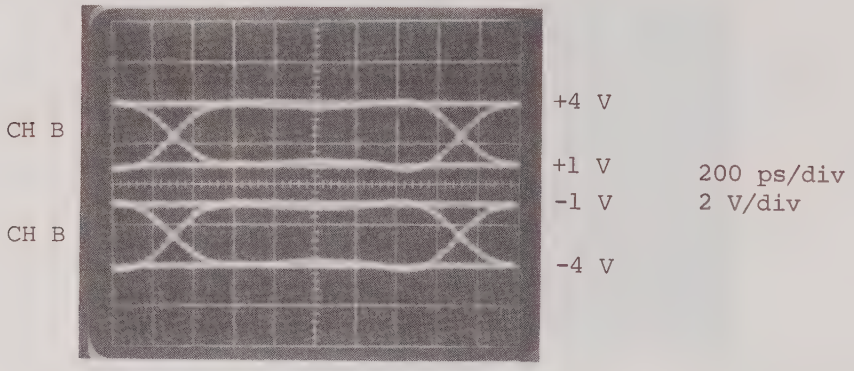


Fig. 6-17 DATA 1 Output Offset

. CLOCK 1 output and DATA 1 output ECL level checks

7 Insert the ECL converter to the input of the oscilloscope.

8 Set the CLOCK 1 and DATA 1 output levels to ECL to -2 V.

9 Apply -5.2 V to the dc voltage input terminal of the ECL level converter from an external dc power supply.

10 Confirm that the waveform on the oscilloscope is as shown in Fig. 6-18.

(Cont.)

Step	Procedure

10
(cont.)

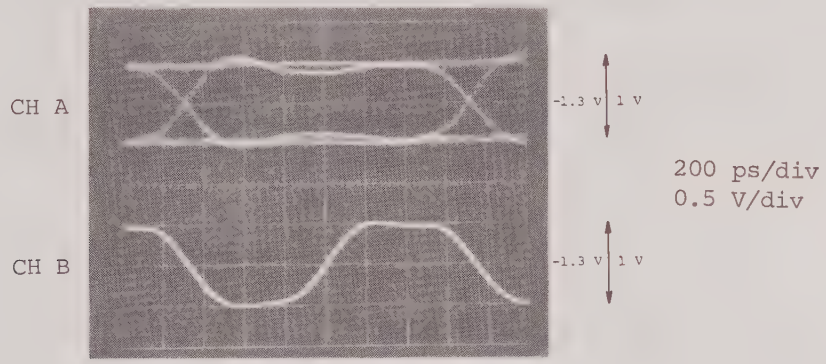


Fig. 6-18 CLOCK 1 Output and DATA 1 ECL Level

Note:

The ECL level of the ME522A is defined as follows.

Amplitude: 1 V

Center voltage: -1.3 V

(when connected to -2 V via 50 Ω.)

6.4.8 CLOCK 2 and DATA 2 outputs

(1) Specification

Operation frequency:

1 MHz to 700 MHz

Waveform:

Clock: RZ (Duty: Within 45 to 55% with internal clock)

Data: NRZ

Level:

Within 0/-1 V ±0.1 V

(2) Setup

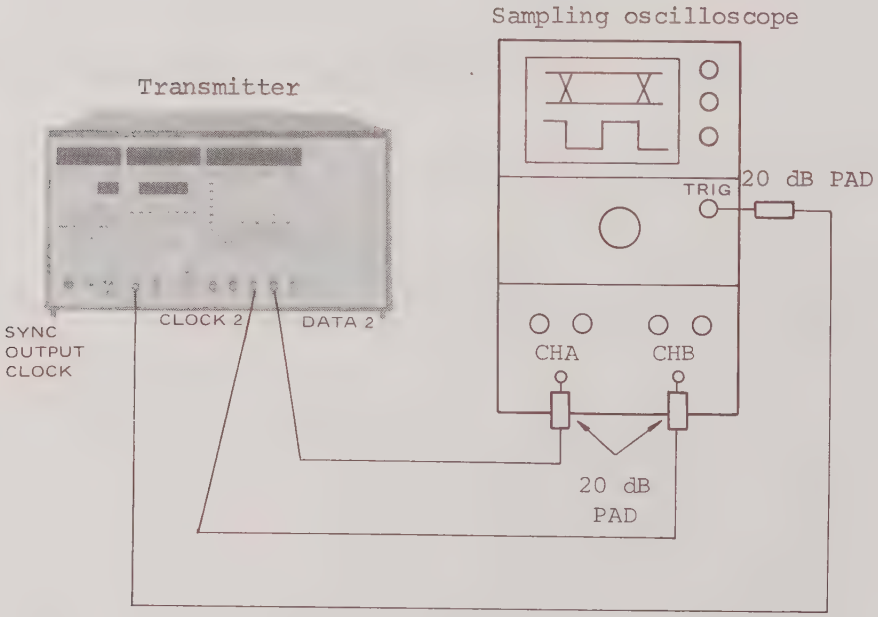


Fig. 6-19 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-19. Use 50 Ω cables and the same length for CH A and CH B.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) or F1 (1.000 MHz) PATTERN: PRBS 2^{23}-1 ERROR ADDITION: OFF LOAD: 50 Ω
3	Confirm that the waveform on the oscilloscope is as shown in Fig. 6-20.

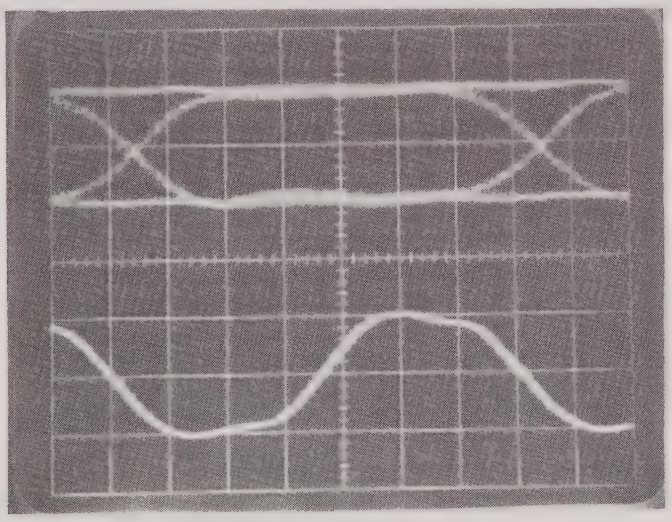


Fig. 6-20 CLOCK 2 Output and DATA 2 Output Waveforms

6.4.9 Load

The checking method explained here is for a 75 Ω load.

(1) Specifications

Switching between 50 Ω and 75 Ω is possible
(But clock 1, 2 and data 1, 2, 3 are coupled)

(2) Setup

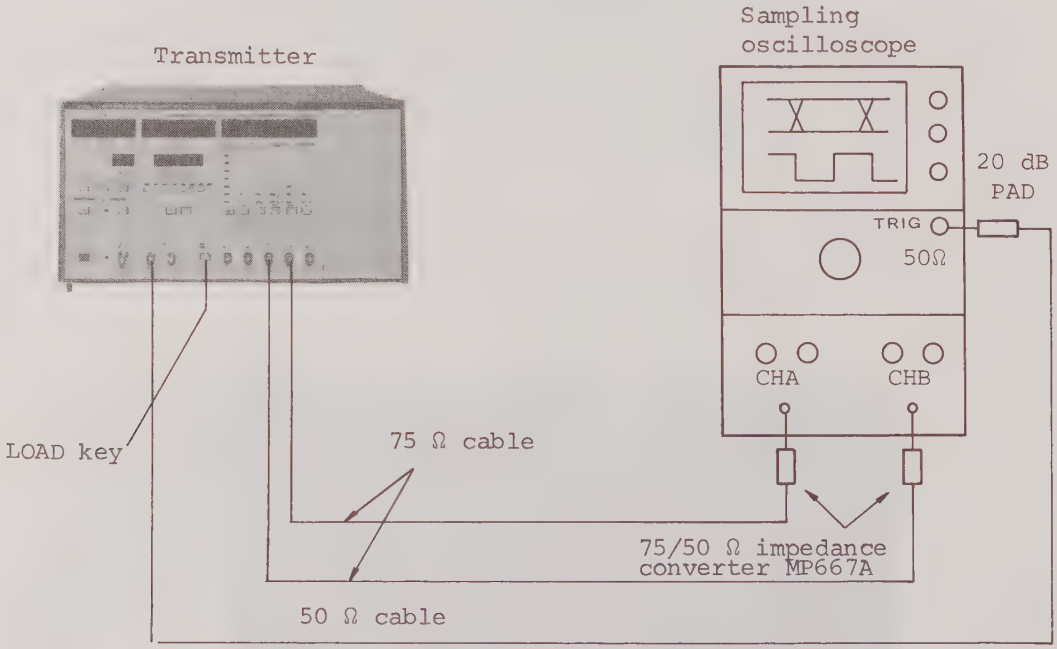


Fig. 6-21 Output Check at 75 Ω Load

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-21.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: PRBS 2^{23}-1 ERROR ADDITION: OFF LOAD: 75 Ω
3	Check each output waveform on the oscilloscope as shown in Fig. 6-22.

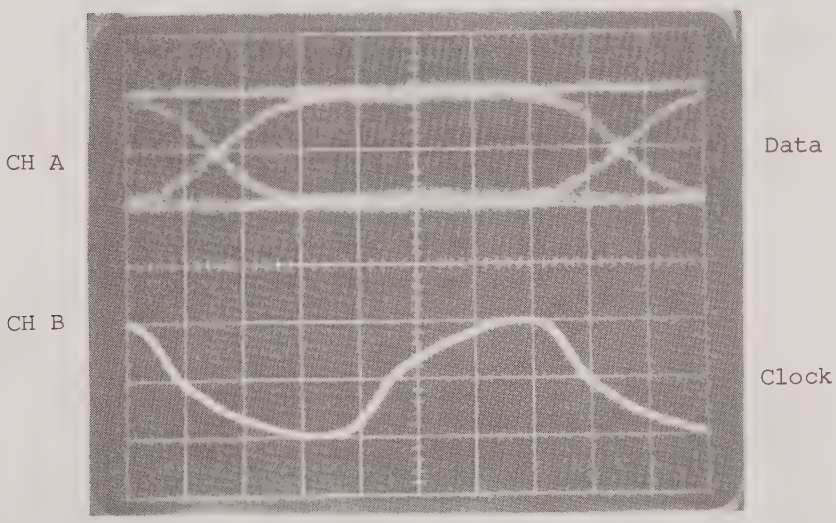


Fig. 6-22 Waveform at 75 Ω LOAD

6.4.10 DATA 3 to DATA 6 outputs

(1) Specifications

Operation frequency:

1 MHz to 150 MHz

Number of outputs:

4 (DATA 3 on the front panel, DATA 4 to 6 on the rear panel. Same phase.)

Level:

Within 1 ±0.1 Vp-p

Load:

Data 3: Switching between 50 Ω and 75 Ω is possible

Data 4 to 6: 75 Ω

Connector:

BNC

(2) Setup

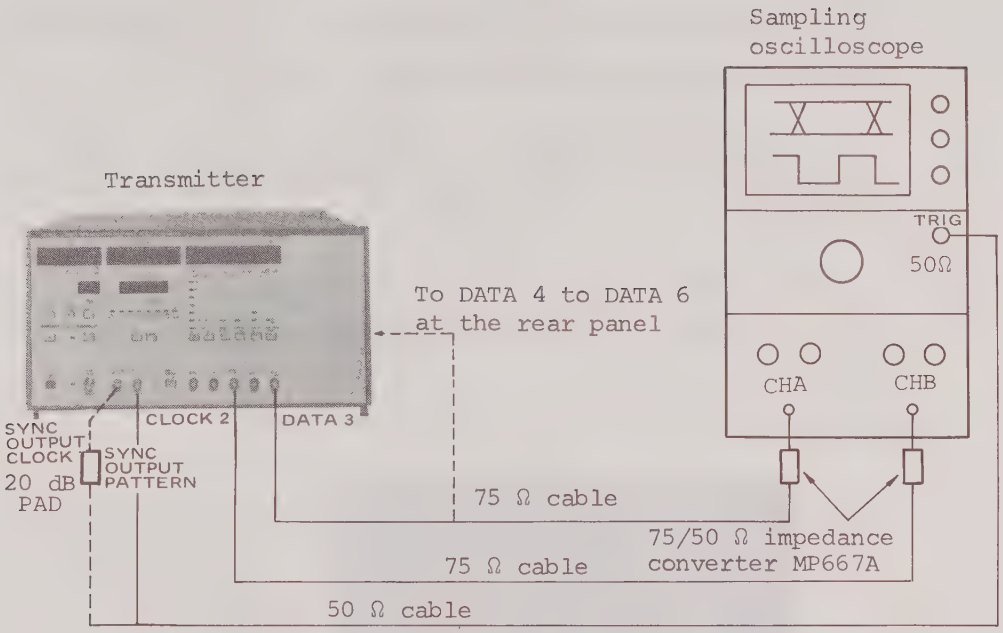


Fig. 6-23 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-23.
2	Set the transmitter as follows. CLOCK: INTERNAL VARIABLE PATTERN: PROGRAMMABLE WORD A ERROR ADDITION: OFF LOAD: 75 Ω

(Cont.)

Step	Procedure
3	Set the internal clock frequency to 150.000 MHz.
4	Write "10011100" PROGRAMMABLE WORD A.
5	Connect the sampling oscilloscope trigger input connector the SYNC OUTPUT PATTERN connector with a 50 Ω cable.
6	Confirm that the waveform on the sampling oscilloscope is the same as the waveform shown in Fig. 6-24.

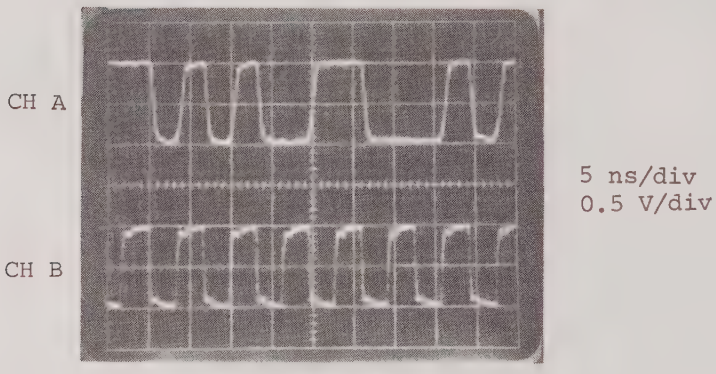


Fig. 6-24 CMI Output Waveform

7	Set the internal clock frequency to 139.264 MHz.
8	Set PATTERN to PRBS 2^{23}-1.
9	Connect the sampling oscilloscope trigger input connector and the SYNC OUTPUT CLOCK connector with a 50 Ω cable through a 20 dB pad.
10	Confirm that the waveform on the sampling oscilloscope satisfies the pulse mask diagram shown in Fig. 6-25.

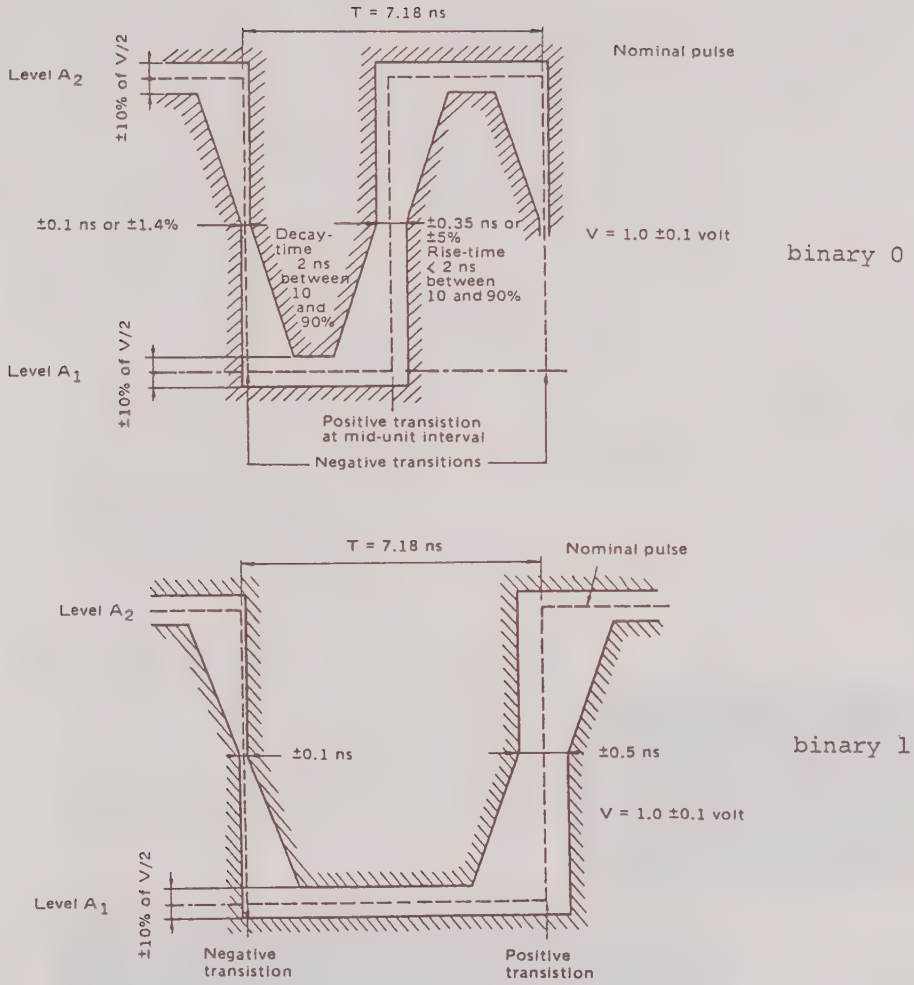


Fig. 6-25 Pulse Mask Diagram of 139.264 Mb/s CMI Interface

6.4.11 Gate signal input

(1) Specification

Operation frequency:

DC to 1/4 of the clock frequency

Level, termination, connector:

Within 0/-1 V ±0.1 V
(0 V: Signal through;
-1 V: Signal inhibit), 75 Ω, BNC

(2) Setup

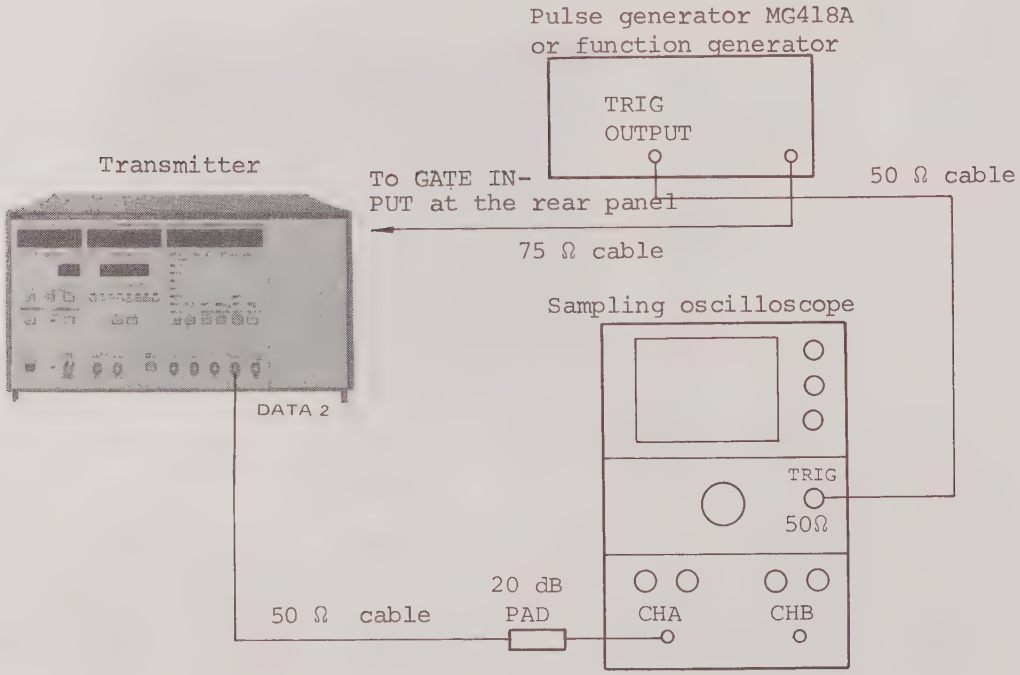
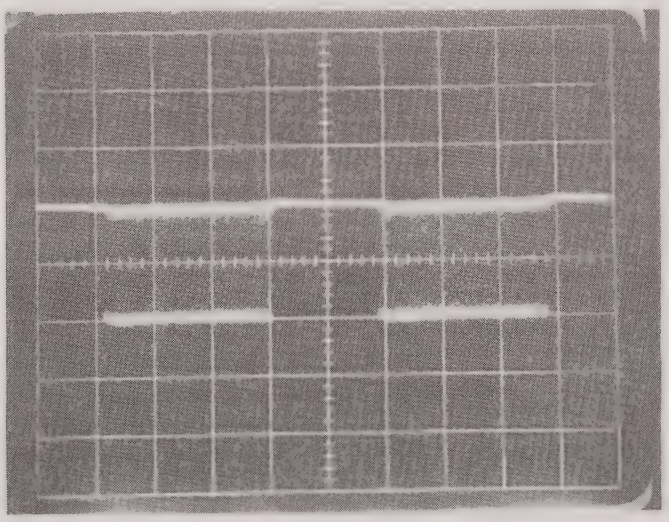


Fig. 6-26 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-26.
2	Set the transmitter as follows. CLOCK: INTERNAL MEMORY F9 (700.000 MHz) PATTERN: PRBS 2^{23}-1 ERROR ADDITION: OFF LOAD: 50 Ω
3	Set the pulse generator or the function generator as follows. Frequency: 10 MHz Duty: 50% Level: 0/-1 V (For 75 Ω load)
4	Confirm that the waveform on the sampling oscilloscope is the same as the waveform in Fig. 6-27.



20 ns/div
0.5 V/div

Fig. 6-27 Gated Output Waveform

6.5 Receiver

6.5.1 Unipolar input

(1) Operation frequency

(a) Specification

1 MHz to 700 MHz

(b) Setup

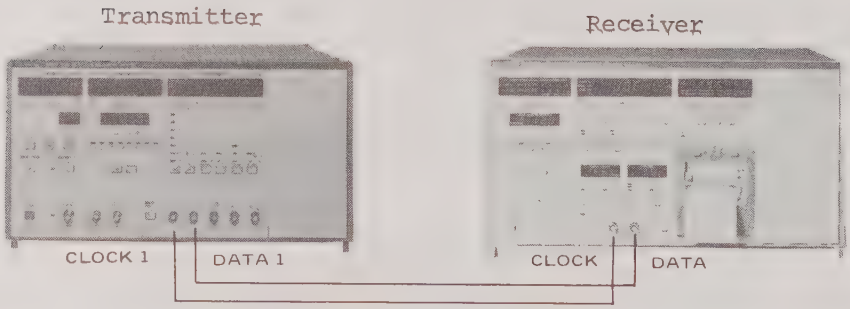


Fig. 6-28 Setup

(c) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28. Use coaxial cables that are adaptable to the impedance (50 or 75 Ω).

(Cont.)

Step	Procedure

2 Set the transmitter and the receiver as follows.

		Transmitter	Receiver
PATTERN		$PRBS2^{23}-1$	
CLOCK 1 OUTPUT or CLOCK INPUT	POLARITY	CLOCK	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
	OFFSET	0.0 V	-
DATA 1 OUTPUT or DATA INPUT	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
	OFFSET	0.0 V	-
	THRESHOLD	-	-0.5 V

3 Confirm that the "ERRORS" LED does not come on when the followings are executed. Set the appropriate values on the input clock and input data phases.

Execution sequence	FORMAT	Transmitter		Receiver
		FREQUENCY	LOAD	TERMINATION
1	NRZ	700 MHz	50 Ω	50 Ω
2	RZ	700 MHz	50 Ω	50 Ω
3	$\overline{RZ}$	700 MHz	50 Ω	50 Ω
4	NRZ	1 MHz	50 Ω	50 Ω
5	NRZ	700 MHz	75 Ω	75 Ω
6	RZ	700 MHz	75 Ω	75 Ω
7	$\overline{RZ}$	700 MHz	75 Ω	75 Ω

(2) DATA input level

(a) Specifications

Amplitude:

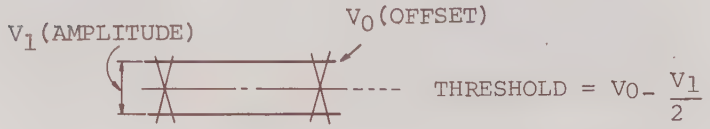
1 to 3 V, ECL

Offset:

-1 to +4 V, ECL

Threshold voltage:

-2.5 to +3.5 V in steps of 0.05 V.
(However, display in steps of 0.1 V)



(b) Setup

Set up as shown in Fig. 6-28. Use 50 Ω cables.

(c) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28.

(Cont.)

Step	Procedure

2 Set the transmitter and the receiver as follows.

		Transmitter	Receiver
FREQUENCY		700 MHz	-
PATTERN		PRBS $2^{23}-1$	
CLOCK 1 OUTPUT or CLOCK INPUT	POLARITY	CLOCK	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
	OFFSET	0.0 V	-
LOAD or TERMINATION		50 Ω	

(Cont.)

Step	Procedure

3 Confirm that the "ERRORS" LED does not come on when the followigs are executed. Set the appropriate values on the input clock and input data phases.

Execution sequence	FORMAT	Transmitter DATA 1 OUTPUT LEVEL	AMPLITUDE	OFFSET	Receiver DATA INPUT LEVEL	THRESHOLD
1	NRZ	VARIABLE	1.0 V	-1.0 V	VARIABLE	-1.5 V
2	RZ	VARIABLE	1.0 V	-1.0 V	VARIABLE	-1.5 V
3	$\overline{RZ}$	VARIABLE	1.0 V	-1.0 V	VARIABLE	-1.5 V
4	NRZ	VARIABLE	1.0 V	+4.0 V	VARIABLE	+3.5 V
5	RZ	VARIABLE	1.0 V	+4.0 V	VARIABLE	+3.5 V
6	$\overline{RZ}$	VARIABLE	1.0 V	+4.0 V	VARIABLE	+3.5 V
7	NRZ	VARIABLE	3.0 V	-1.0 V	VARIABLE	-2.5 V
8	RZ	VARIABLE	3.0 V	-1.0 V	VARIABLE	-2.5 V
9	$\overline{RZ}$	VARIABLE	3.0 V	-1.0 V	VARIABLE	-2.5 V
10	NRZ	ECL	-	-	ECL	-

(3) CLOCK input level

(a) Specifications

Amplitude: 1 to 3 V, ECL

Offset: -1 to +4 V, ECL

(b) Setup

Set up as shown in Fig. 6-28. Use 50 Ω cables.

(c) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28.
2	Set the transmitter and receiver as follows.

		Transmitter	Receiver
FREQUENCY		700 MHz	-
PATTERN		PRBS $2^{23}-1$	
DATA 1 OUTPUT or DATA INPUT	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
	OFFSET	0.0 V	-
	THRESHOLD	-	-0.5 V
LOAD or TERMINATION		50 Ω	

(Cont.)

Step	Procedure

3 Confirm that the "ERRORS" LED does not come on when the followings are executed.

Execution sequence	POLARITY	Transmitter CLOCK 1 OUTPUT LEVEL	AMPLITUDE	OFFSET	Receiver CLOCK INPUT LEVEL
1	CLOCK	VARIABLE	1.0 V	-1.0 V	VARIABLE
2	CLOCK	VARIABLE	1.0 V	+4.0 V	VARIABLE
3	CLOCK	VARIABLE	3.0 V	-1.0 V	VARIABLE
4	CLOCK	ECL	-	-	ECL
5	$\overline{\text{CLOCK}}$	ECL	-	-	ECL

6.5.2 CMI input

(1) Specification

Operation frequency: Within 139.264 MHz ±14 kHz

(2) Setup

Use a 75 Ω cable.

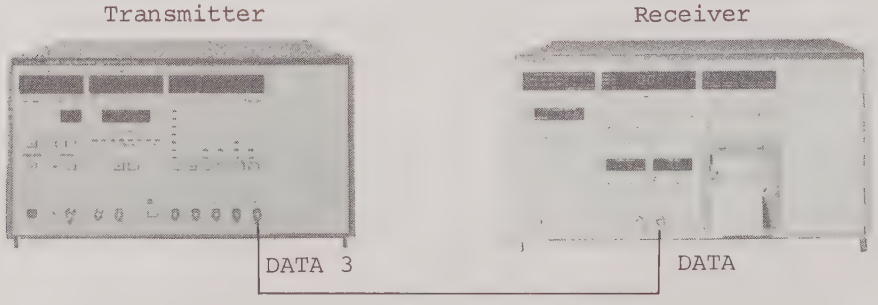


Fig. 6-29 Setup

(3) Procedure

Step	Procedure

1 Set up as shown in Fig. 6-29.

2 Set the transmitter and the receiver as follows.

	Transmitter	Receiver
PATTERN	PRBS $2^{23}-1$	
LOAD or TERMINATION	75 Ω	
FORMAT	-	CMI

3 Confirm that the "ERRORS" LED does not come on when the followings are executed.

Execution sequence	Transmitter FREQUENCY
1	139.264 MHz
2	139.250 MHz
3	139.278 MHz

6.5.3 Pattern

(1) Specifications

Pseudo-random patterns (PRBS):

7 stages, 10 stages, 15 stages,* 23 stages*
(*According to CCITT Rec. O.151)

Programmable patterns:

3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits.
With the initial switch setting, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C.

Isolated patterns:

1/1 to 1/64 (1/m: One mark ("1") in a pattern of m bits)

Logic inversion:

Logic inversion is possible for all of the above patterns.

(2) Setup

Set up as shown in Fig. 6-28. Use 50 Ω cables.

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28.
2	Initialize the transmitter and the receiver.
3	Confirm that the "ERRORS" LED does not come on when the followings are executed.

(Cont.)

Step	Procedure
	. The transmitter and receiver patterns are changed in the order PRBS 2^7-1, 2^{10}-1, 2^{15}-1, 2^{23}-1, PROGRAMMABLE WORDS A, B, C and 1/N. . The transmitter and receiver patterns are set to PRBS 2^{23}-1 and logic is inverted.

6.5.4 Measurement function

(1) ERROR RATE, ERROR COUNT, ERROR INTERVAL, ERROR FREE INTERVAL, FREQUENCY

(a) Specifications

Error rate:

0.0 E - 16 (0.0×10^{-16}) to 1.0 E - 0 (1)

Number of errors:

0 to 99999 to 9.9 E 16 (9.9×10^{16})

Error interval:

Switching is possible between the intervals of 0.01 s, 0.1 s, and 1 s.
Switching is possible between synchronous mode and asynchronous mode
0 to 99999 to 9.9 E 16 (9.9×10^{16})

Error free interval:

0.0000% to 100%

Frequency:

1.000 MHz to 700.000 MHz.
Error: Within ±(20 ppm + 1 kHz)

(b) Setup

Set up as shown in Fig. 6-28. Use 50 Ω cables.

(c) Procedure

Step	Procedure			
1	Set up as shown in Fig. 6-28.			
2	Set the transmitter and the receiver as follows.			
			Transmitter	Receiver
	FREQUENCY		700 MHz	-
	PATTERN		PRBS $2^{23}-1$	
	CLOCK 1 OUTPUT or CLOCK INPUT	POLARITY	CLOCK	
		LEVEL	VARIABLE	
		AMPLITUDE	1.0 V	-
		OFSET	0.0 V	
	DATA 1 OUTPUT or DATA INPUT	FORMAT	NRZ	
		LEVEL	VARIABLE	
		AMPLITUDE	1.0 V	-
		OFFSET	0.0 V	-
		THRESHOLD	-	-0.5 V
	LOAD or TERMINATION		50 Ω	
	MEASURE-MENT	MEAS MODE	-	SINGLE
		AUTO SYNC	-	ON
		INTERVAL	-	1 sec
	TIME	MEAS PERIOD	-	TIME
		MEAS TIME	-	10 seconds
	ERROR ADDITION		SINGLE	

(Cont.)

Step	Procedure
3	Pres the [START] key. When the GATING LED comes on, press the transmitter ERROR ADDITION [SINGLE] key once. It is normal if the display is as follows after 10 seconds have elapsed. ERROR RATE: 1.4E-10 ERROR COUNT (number of errors): 1 ERROR INTERVAL: 1 ERROR FREE INTERVAL: 90.0000% FREQUENCY: 699.985 MHz to 700.015 MHz

(2) VOLTAGE

(a) Specification

0.0 to 20.0 V. Error: Within ±(2% +0.1 V)

(b) Setup

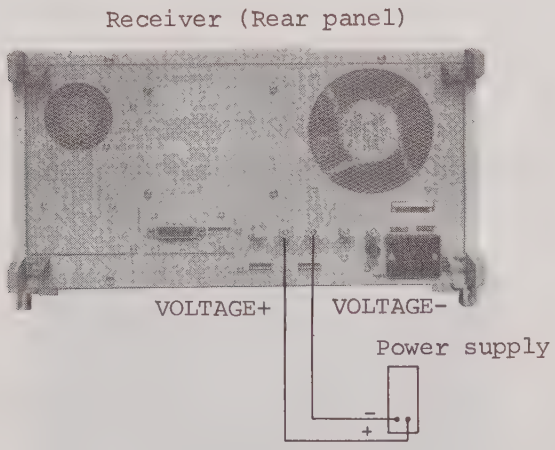


Fig. 6-30 Setup

(c) Procedure

Step	Procedure
1	Set the power supply voltage to +19.0 V.
2	Set up as shown in Fig. 6-30.
3	The measurement is normal if the VOLTAGE display is within 18.5 to 19.5 V.

6.5.5 Alarm output

(1) Specifications

Normal:

Open between 2 terminals

Abnormal (Power failure, signal loss, pattern sync loss, AIS):

Short-circuit between 2 terminals.

(2) Setup

Set up the transmitter and the receiver as shown in Fig. 6-28. Use 50 Ω cables. Set up the receiver and the multimeter as shown in Fig. 6-31.

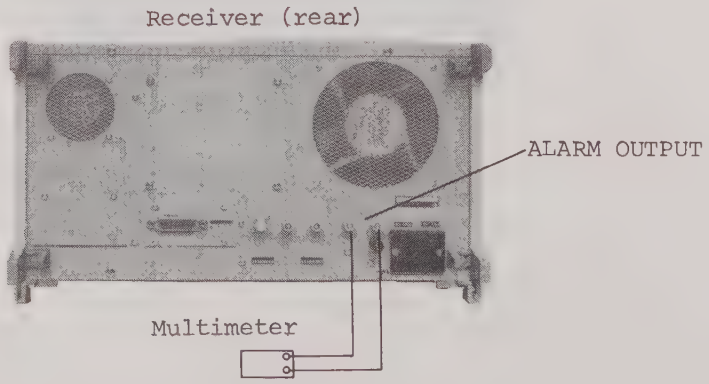


Fig. 6-31 Setup

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28.
2	Set up as shown in Fig. 6-31. Set the multimeter to resistance measurement mode.
3	Set the transmitter and the receiver as follows.

		Transmitter	Receiver
FREQUENCY		700 MHz	-
PATTERN		PRBS 2^{23}-1	
CLOCK 1 OUTPUT or CLOCK INPUT	POLARITY	CLOCK	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
DATA 1 OUTPUT or DATA INPUT	OFFSET	0.0 V	-
	FORMAT	NRZ	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
	OFFSET	0.0 V	-
	THRESHOLD	-	-0.5 V
LOAD or TERMINATION		50 Ω	

4	Confirm that the ALARM OUTPUT terminals are open.
5	Disconnect the cable that connects the transmitter and receiver clocks, and confirm that the ALARM OUTPUT terminals are short-circuited.

6.5.6 Printer

(1) Specification

Printing contents:

Measured values (intermediate and final values), error occurrence, alarm status, threshold error interval, threshold error free interval, error performance data, time.

(2) Setup

Set up as shown in Fig. 6-28. Use 50 Ω cables.

(3) Procedure

Step	Procedure
1	Set up as shown in Fig. 6-28.
2	Set the transmitter and the receiver as follows.

		Transmitter	Receiver
FREQUENCY		700 MHz	-
PATTERN		PRBS $2^{23}-1$	
CLOCK 1 OUTPUT or CLOCK INPUT	POLARITY	CLOCK	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	-
DATA 1 OUTPUT or DATA INPUT	OFFSET	0.0 V	-
	FORMAT	NRZ	
	LEVEL	VARIABLE	
	AMPLITUDE	1.0 V	
	OFFSET	0.0 V	
	THRESHOLD	-	-0.5 V

(Cont.)

Step	Procedure

(cont.)

	Transmitter	Receiver
LOAD or TERMINATION	50 Ω	
AUTO SYNC	-	ON
ERROR ADDITION	SINGLE	-
PRINT	-	ON

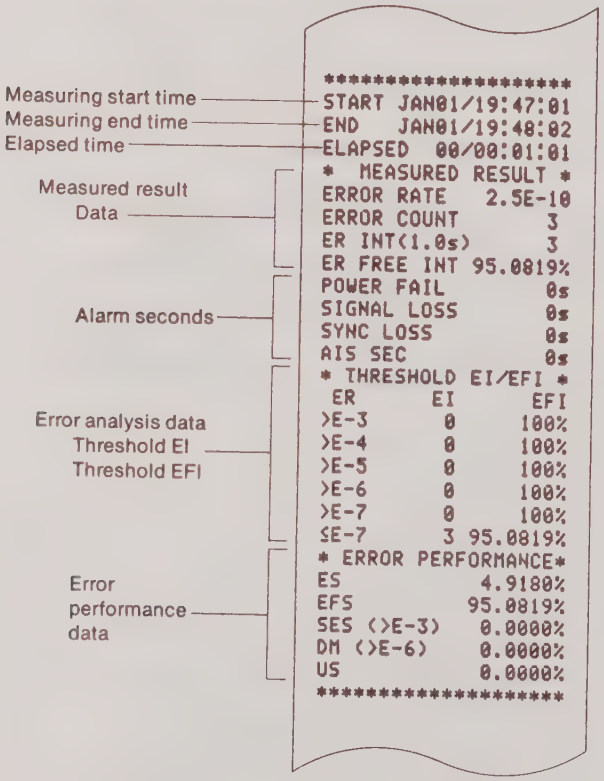
3 Set the receiver as follows.

MEASUREMENT	MEAS MODE	SINGLE
TIME	MEAS PERIOD	TIME
	MEAS TIME	10 seconds
FUNCTION 1	Bit 1	0
	Bit 2	1
	Bit 3	1
	Bit 4	0
FUNCTION 2	Bit 1	0
	Bit 2	0
	Bit 3	0

(Cont.)

Step	Procedure

4 Press the [START] key. When the GATING LED comes on, press the transmitter ERROR ADDITION [SINGLE] key once. The printer is normal if the printed data is as follows after 10 seconds have elapsed.



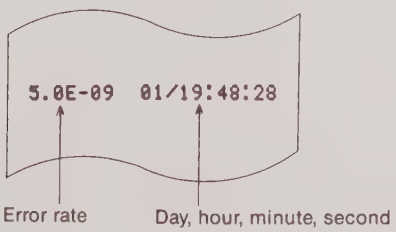
(Cont.)

Step	Procedure

5 Set the receiver as follows.

MEASUREMENT	MEAS MODE	UNTIMED
FUNCTION 2	Bit 3	1
	Bit 4	0
	Bit 5	0
	Bit 6	0
	Bit 7	0

6 Press the [START] key. When the GATING LED comes on, press the transmitter ERROR ADDITION [SINGLE] key once. The printer is normal if the one second data is as shown below.



SECTION 7

GP-IB

7.1 General

This section explains the standard GP-IB.

When Option 70 GP-IB interface is mounted in the receiver, refer to the separate ME522A GP-IB interface (option 70) operation manual.

The ME522A general purpose interface bus (GP-IB) is an interface that conforms to the IEEE-488 and IEC-625 recommendations.

All keys on the ME522A panel except the POWER switch and PANEL LOCK key can be controlled through the GP-IB.

The ME522A can output the panel settings and measured results through the GP-IB.

7.2 Functions

SH1: Supports all source handshake functions.

AH1: Supports all accept handshake functions.

T6 (Transmitter) and T5 (Receiver):

Supports talker function, talk-only function (receiver only), serial polling function and talker release function by my listen address (MLA).

L3: Supports listener function, listen-only function, and listener release function by my talk address (MTA).

SR1: Supports all service request functions.

RL1: Supports all remote/local functions.

PP0: No parallel polling function.

DC0 (Transmitter) and DC1 (Receiver):

Only the receiver supports a device clear function. When the receiver receives a device clear signal, it simply discards the old measurement data.

DT0: No device trigger function.

C1 (Transmitter) and C0 (Receiver):

Only the transmitter supports a control function. The transmitter becomes a controller in the self-test mode.

7.3 Measurement Preparations

7.3.1 Cable connections

Up to 15 devices can be connected to a GP-IB system, but attention is required regarding the length of the cables used for the connections since they are restricted as follows:

(1) The length of a single cable must not exceed 2 meters.

(2) The total length of the cables must not exceed 20 meters.

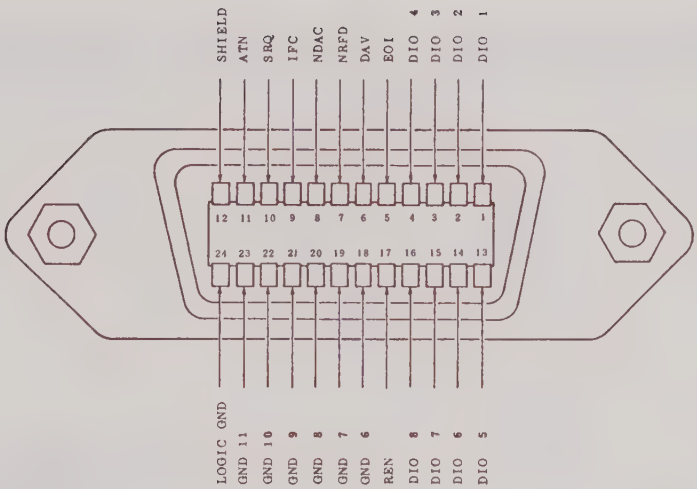


Fig. 7-1 GP-IB Interface Connector Pin Arrangement

7.3.2 Example

Figure 7-2 gives an example of how the GP-IB is used.

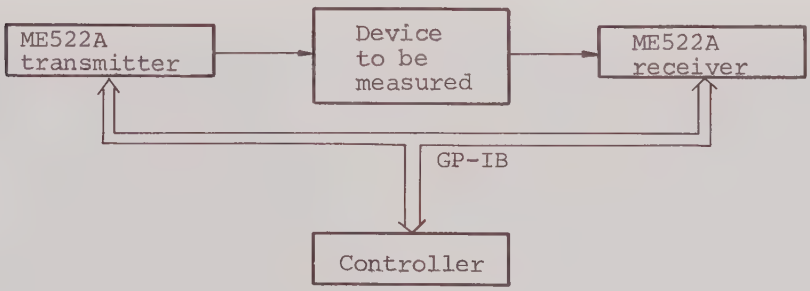
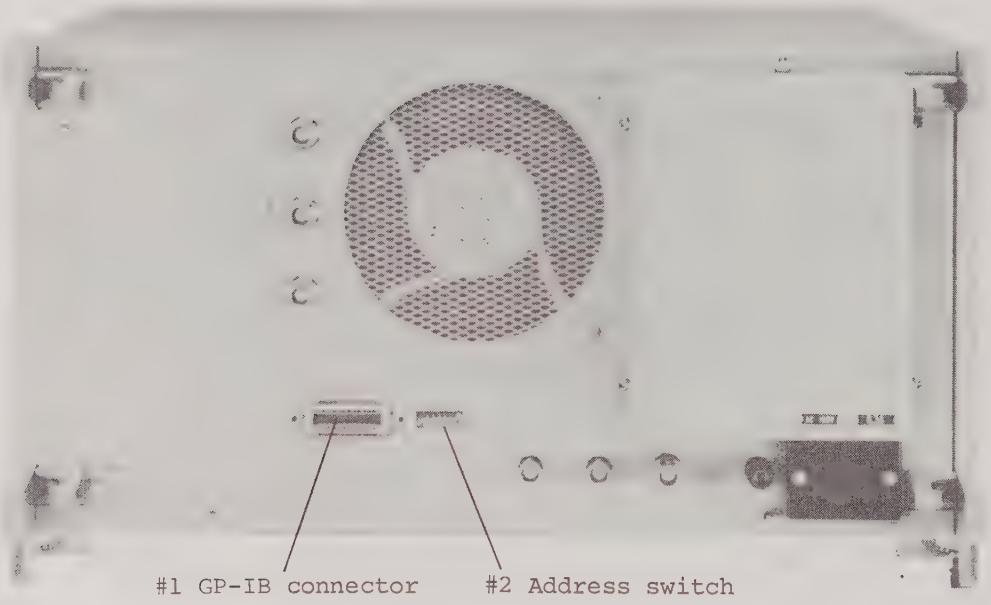


Fig. 7-2 GP-IB Usage

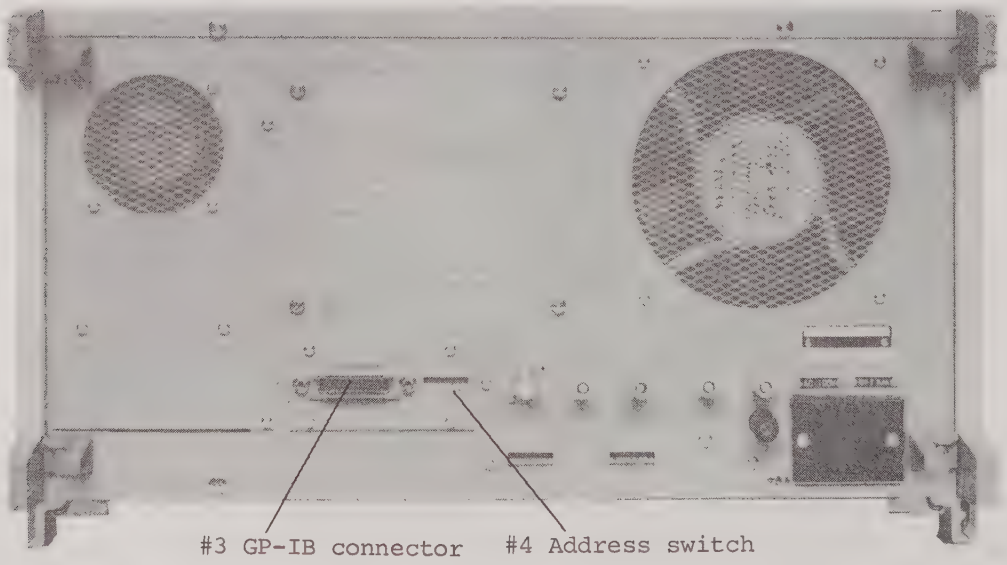
7.3.3 Address setting

An address must be set for operation a device on the GP-IB. The ME522A address is set with the address switches #2 (transmitter) and #4 (receiver) shown in Fig. 7-3.

The ME522A confirms the address only when the power is turned on. Therefore, when an address is changed, turn the power off and then on again.



(a) Transmitter (Rear Panel)



(b) Receiver (Rear Panel)

Fig. 7-3 ME522A GP-IB

Figure 7-4 shows an address setting example.

Fig. 7-4 Address Switches

A1 to A5 in Fig. 7-4 have the following values.

A1 : $2^0 = 1$
A2 : $2^1 = 2$
A3 : $2^2 = 4$
A4 : $2^3 = 8$
A5 : $2^4 = 16$

Therefore, the address in the Fig. 7-4 example is 3. The addresses that can be used in the ME522A is 0 to 29. The three bits on the left side of the switches support the following functions.

These three bits must be set to OFF for other than the following uses.

(1) LON

This is a listen-only mode.

The A1 to A5 settings are ignored in this mode.

This mode is used only for setting the ME522A panel.

Figure 7-5 shows an example of how LON is used.

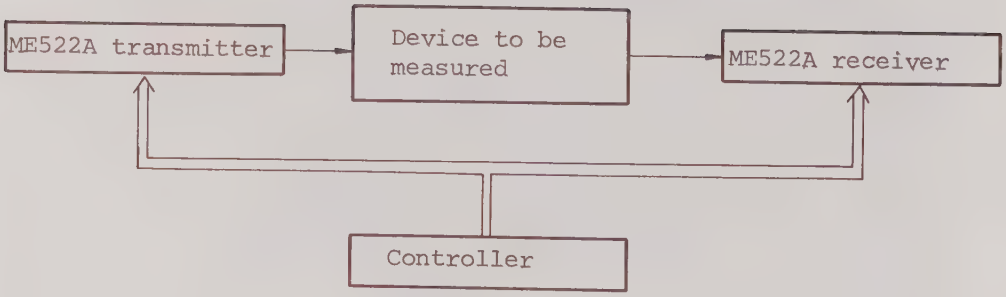


Fig. 7-5 LON Usage

(2) TON (Receiver only)

This is a talk-only mode.

The A1 to A5 settings are ignored in this mode.

This mode is used to output the measurement data to an external printer.

The output data and timing are the same as for the built-in printer.

Figure 7-6 shows an example of how TON is used.

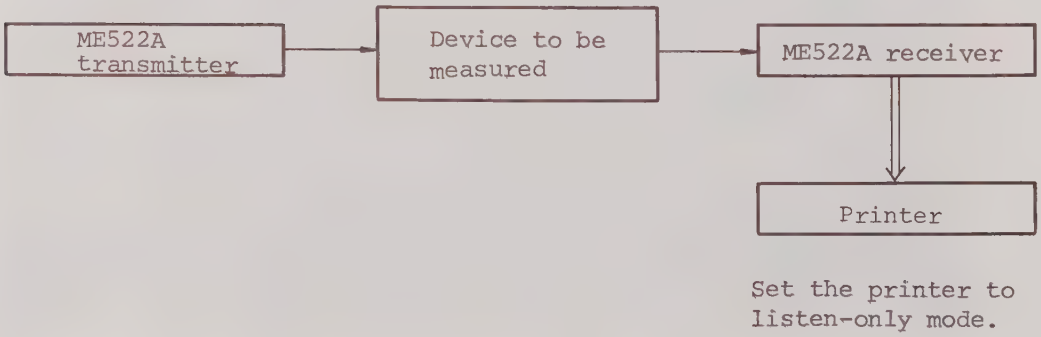


Fig. 7-6 TON Usage

(3) LON and TON

When LON and TON are simultaneously on, the ME522A goes into a pattern information transfer mode. In this mode, the pattern set in the transmitter is automatically transferred to the receiver through the GP-IB. For details, see paragraph 3.5.

(4) SELF T

This is a self-test mode.

In this mode, the transmitter and the receiver are self-tested. For details, see Section 5.

7.4 Operation

Operation is explained using an Anritsu Packet III as a controller.

7.4.1 ME522A panel setting

The address of the ME522A transmitter is assumed to be 1, and the address of the receiver to be 2. The panel is set as follows.

WRITE @101: " "

Address (For transmitter)

Write in the control codes that correspond to the ME522A panel keys, which are explained later, enclosed in the quotation marks.

When more than one setting is made on the panel, separate the setting codes with commas as follows.

WRITE @101: " , , "

Tables 7-1 and 7-2 show the control codes that correspond to the panel keys.

Table 7-1 ME522A Transmitter Control Codes

Item		Control code	Remarks
CLOCK	EXTERNAL	CEX	. Always specify all digits for frequency setting. Example: CDF001.500 for 1.5 MHz
	VARIABLE	CIV	
	MEMORY	CIM1 to CIM9	
	Frequency setting	CDF001.000 to CDF700.000	
PATTERN	PRBS7	P07	. PRBS15 P15: Conforms to CCITT P51: ANRITSU MEV7 compatible . When setting a programmable pattern, separate the data into 4-bit sections, and express each section in hexadecimal. . See paragraph 7.4.1(1) for the setting procedures. 0000 D110 1011 1000 [0] [6] [B] [8] . For alternate pattern D/E, assign 001 as the D address and 002 as the E address. . Express N or address setting, always by three digits. Example: TPN015 when N is 15.
	PRBS10	P10	
	PRBS15	P15 P51	
	PRBS23	P23	
	PROG A	PRA	
	PROG B	PRB	
	PROG C	PRC	
	ALT D/E	PAL	
	1/N	PIN	
	N	PTN1 to PTN256	
	LOGIC Normal	PLN	
	LOGIC Invert	PLI	
	Address	PAD001 to PAD256	
ERROR ADDITION	OFF	EOF	
	EXTERNAL	EEX	
	SINGLE	ESI	
	2×10^{-7}	ER7	
	2×10^{-6}	ER6	
	2×10^{-5}	ER5	
	2×10^{-4}	ER4	
	2×10^{-3}	ER3	

Table 7-1 ME522A Transmitter Control Codes (Continued)

Item		Control code	Remarks
CLOCK OUTPUT	CLOCK	OCN	. Always set AMPLITUDE and OFFSET to two decimal places. Example: OCA 1.50 when the clock AMPLITUDE is 1.5 V. . Set the AMPLITUDE and OFFSET in 0.5 V steps.
	$\overline{\text{CLOCK}}$	OCI	
	ECL	OCE	
	VARIABLE	OCV	
	AMPLIITUDE	OCA1.00 to OCA3.00	
	OFFSET	OCO-1.00 to OCO4.00	
DATA OUTPUT	NRZ	ODN	
	RZ	ODR	
	$\overline{\text{RZ}}$	ODZ	
	ECL	ODE	
	VARIABLE	ODV	
	AMPLITUDE	ODA1.00 to ODA3.00	
	OFFSET	ODO-1.00 to ODO4.00	
LOAD	50 Ω	L50	
	75 Ω	L75	

Table 7-2 ME522A Receiver Control Codes

Item			Control code	Remarks
CLOCK INPUT	CLOCK		ICN	
	$\overline{\text{CLOCK}}$		ICI	
	ECL		ICE	
	VARIABLE		ICV	
	PHASE		ICP-5 to ICP5	
DATA INPUT	CMI		IDC	. Set THRESHOLD in 0.05 steps. . Always set THRESHOLD to two decimal digits places. Example: IDT 1.50 when the THRESHOLD is 1.5 V.
	$\overline{\text{RZ}}$		IDZ	
	RZ		IDR	
	NRZ		IDN	
	ECL		IDE	
	VARIABLE		IDV	
	THRESHOLD		IDT-2.50 to IDT 3.50	
TERMINATION	50 Ω		T50	
	75 Ω		T75	
PATTERN	PRBS7		P07	. The setting procedures of PATTERN are the same as for the transmitter.
	PRBS10		P10	
	PRBS15		P15 P51	
	PRBS23		P23	
	PROG A		PRA	
	PROG B		PRB	
	PROG C		PRC	
	1/N		PIN	
	N		PTN001 to PTN256	
	LOGIC	Normal	PLN	
		Invert	PLI	
	ADDRESS		PAD001 to PAD256	

Table 7-2 ME522A Receiver Control Codes (Continued)

Item			Control code	Remarks
MEASURE-MENT	HISTORY RESET		MHR	
	DISPLAY			
		ERROR RATE	MER	
		ERROR CONT	MEC	
		ERROR INTERVAL	MEI	
		ERROR FREE INTERVAL	MEF	
		FREQUENCY	MFR	
		VOLTAGE	MVO	
	INTERVAL			
		0.01 s	MIC	
		0.1 s	MIB	
		1 s	MIA	
	MEAS MODE			
		UNTIMED	MMU	
		SINGLE	MMS	
		REPEAT	MMR	
	START *		MST	
	STOP		MSP	
	CURRENT	ON	MCN	
	DATA	OFF	MCF	
	AUTO	ON	MSN	
	SYNC	OFF	MSF	
	BUZZER	ON	MBN	
		OFF	MBF	

Table 7-2 ME522A Receiver Control Codes (Continued)

Item		Control code	Remarks
TIME	DISPLAY		
	YM	TDY	
	DHMS	TDD	
	PRESET	TDP	
	TIMED	TDT	
	ELAPSED	TDE	
	MEAS PERIOD		
	TIME	TPT	
	CLOCK	TPC	
TIME SET	REAL TIME		
	YEAR	TRY00 to TRY99	
	MONTH	TRM01 to TRM12	
	DAY	TRD01 to TRD31	
	HOUR	TRH00 to TRH23	
	MINUTE	TRN00 to TRN59	
	SECOND	TRS00 to TRS59	
	MEAS PERIOD		
	DAY	TMD00 to TMD99	
	HOUR	TMH00 to TMH23	
	MINUTE	TMM00 to TMM59	
	SECOND	TMS00 to TMS59	
	CLOCK	TMC07 to TMC15	

Table 7-2 ME522A Receiver Control Codes (Continued)

Item			Control code	Remarks
PRINTER	PRINT	OFF	RPF	. PAPER FEED is set for one line per command.
		ON	RPN	
	LETER	ABCD	RLN RLI	
	MANUAL PRINT		RMP	
	PAPER FEED		RPA	
	INTER-MEDIATE DATA	OFF	RIF	
	PRINTING	ON	RIN	
	PAPER	OFF	RSF	
	SAVING	ON	RSN	
FUNC-TION 1	ERROR	SYNC	EIS	. When the power is turned ON, the setting is as set by the rear panel switch.
	INTERVAL	ASYNC	EIA	
FUNC-TION 2	THRESHOLD	OFF	ETF	
	EI, EFI	ON	ETN	
	ERROR	OFF	EPF	
	PERFORMA-NCE	ON	EPN	
		10^{-3}	ET3	
		10^{-4}	ET4	
	VOLTAGE	MIN	EVI	
		MAX	EVA	
	Measure-ment data	All	EDA	
		Error rate or Number of errors	EDS	

Table 7-2 ME522A Receiver Control Codes (Continued)

Item		Control code	Remarks
	OFF	EEF	
	ON	EEN	
One second data	Error rate or	EER	
	Number of errors	EEC	
	ER>0	EE0	
	EC>1		
	$ER>10^{-6}$	EE6	
	EC>10		
	$ER>10^{-4}$	EE4	
	EC7100		
	$ER>10^{-3}$	EE3	
	EC>1000		
MONITOR INPUT	OFF	EMF	
	ON	EMN	

(1) Panel setting examples

(a) Frequency setting

When setting 564.992 MHz to F5 memory, set as follows:

WRITE @101: "CIM 5, CDF 564.992"

5 → F5

564.992 → 564.992 MHz

(b) Programmable pattern setting

When setting the following 24-bit pattern to programmable pattern A, set as follows.

	1000	1100	1110	1111	1010	0000
Code	[8]	[C]	[E]	[F]	[A]	[0]
Address	001		002		003	

WRITE @101: "PRA, PTN 003, PAD 001, 8C, EF, A0"

003 → 3 x 8 = 24 bits

001 → Initial

8C, EF, A0 → Pattern address

When the initial address is specified, the subsequent addresses are automatically increased.

Address	Pattern
1	8C
2	EF
3	A0

(c) Programmable pattern change

For changing a pattern as follows:

1000	1100	1110	1111	1010	0000
		⇓			
1000	1100	1110	1101	1010	0001
		[E]	[D]	[A]	[1]

WRITE @101 : "PAD 002, ED, A1"

(d) Output level setting

When setting the clock amplitude to 2 V, clock offset to -0.55 V, data amplitude to 1.25 V and data offset to 2.4 V, set as follows.

```
WRITE @101:"OCV, OCA 2.00, OCO - 0.55,
            ODV, ODA 1.25, ODO 2.40"
```

When the LEVEL is set at VARIABLE, three codes are not required.

(e) Measuring time setting

When setting the measuring time to 10 minutes and one second, set as follows.

(i) When the current setting is for 30 days, set as follows.

```
WRITE @102:"TMD00, TMM10, TMS01"
```

(ii) When the current setting is for one second, set as follows.

```
WRITE @102:"TMM10"
```

7.4.2 ME522A panel setting read-out

The ME522A can output the contents of the panel settings and the programmable patterns.

An example of a program to read the panel setting is given below.

```
10   DIM A$ * 255
20   WRITE @101: "          "
                  └─Read-out code (See Tables
                    7-3 and 7-4.)
30   READ @101: A$
40   PRINT A$
50   GO TO 30
60   END
```

For the receiver, and a program as shown below to distinguish this data from the measurement data.
(In this case, the addresses in line No. 20 and 30 must be changed to 2.)

```
12   DCL @102
```

This is a command to keep the old measurement data from being output.

```
14   WAIT DELAY 0.5
```

Waits for 0.5 second.

```
16   WRITE @102: "EGF"
```

This command prevents measurement data from being output.

Table 7-3 ME522A Transmitter Read-out Codes

Item	Code	Remarks
Key settings	GSW	
PROG A	GPA	
PROG B	GPB	
PROG C	GPC	
ALT D/E	GAL	
1/N	GIN	

Table 7-4 ME522A Receiver Read-out Codes

Item	Code	Remarks
Key settings	GSW	
PROG A	GPA	
PROG B	GPB	
PROG C	GPC	
1/N	GIN	

Data is output as follows.

[DATA] [CR] [LF]

When the word length is too long in programmable patterns A, B and C to output at one time, the pattern is divided and output as follows.

(1) When the word length N is $\leqq$ 64.

[Patterns of N = 1 to 64] [CR] [LF]

(2) When the word length N is $\geqq$ 65 and $\leqq$ 128.

[Pattern of N = 1 to 64] [CR] [LF]

[Patterns of N = 65 to 128] [CR] [LF]

(3) When the word length N is $\geqq$ 129 and $\leqq$ 192.

[Pattern of N = 1 to 64] [CR] [LF]

[Pattern of N = 65 to 128] [CR] [LF]

[Pattern of N = 129 to 192] [CR] [LF]

(4) When the word length N is $\geqq$ 193 and $\leqq$ 256.

[Patterns of N = 1 to 64] [CR] [LF]

[Patterns of N = 65 to 128] [CR] [LF]

[Patterns of N = 129 to 192] [CR] [LF]

[Patterns of N = 193 to 256] [CR] [LF]

Examples of pattern outputs are given below.

(a) Transmitter key settings

```
CIV,CDF700.000,P23,PLN,EOF,OCN,OCV,OCA1.00,OCO0.00,ODN,ODV,ODA1.00,ODO0.00,L50
```

(b) Programmable pattern (Word length N = 128)

Address 1 Address 2

```
PRA,PTN128,7F,EF,DB,BE,6C,BD,AB,C2,8A,49,FE,7C,99,EA,51,C8,1D,C3,09,2F,EB,D2,AE,
08,6D,3E,CD,D7,24,7E,1C,40,6F,3A,45,E5,4C,34,9B,EE,D9,FA,75,89,8E,81,5D,12,9E,64
,AF,8B,0B,2B,63,E0,C6,42,EA,90,7B,17,14,12
DE,F5,A9,C6,02,7B,96,36,1E,44,E7,08,2D,AF,CB,9A,2D,2E,E9,96,B7,3C,48,7D,1A,8C,44
,66,2A,21,35,D9,3B,C6,83,59,9A,AC,0C,E5,0C,A5,9D,A3,D0,AA,80,5F,56,87,50,8A,C8,D
C,70,03,F8,F0,23,B0,73,05,34,DB
```

(c) Alternate pattern

```
PAL,FF,00
     D  E
```

(d) 1/N pattern (N = 12)

```
PIN,PTN012
```

7.4.3 Fetching receiver measurement data

The receiver outputs measurement data by the following two methods.

1. Automatic output
2. Outputs only when requested.

These are classified according to the codes given in Table 7-5 which follows.

(1) Automatic output

The contents and output timing of the measurement data are as follows.

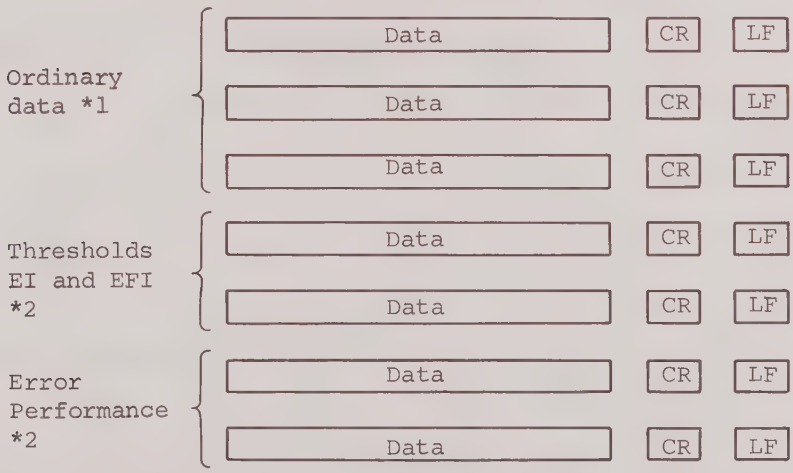
1. Measurement end data; When a measurement ends.
2. One second data: When an error occurs.

   The one second data output can be turned on or off, or restricted with the one second data (FUNCTION 1 and FUNCTION 2) codes listed in Table 7-2.

3. Alarm data: When an alarm occurs and when it is restored.

   The output data is the same as the output data for printer.

   The measurement end data are divided and output in several sections shown below.



*1 For ordinary data, only the error rate and error count can be output. (See Table 7-2.)

*2 The outputs of the thresholds EI and EFI, and error performance can be turned on or off. (See Table 7-2.)

Fig. 7-7 Measurement End Data

An example of a program to fetch the measurement data is given below.

(a) When service request (SRQ) is used

The ME522A can issue SRQ when outputting measurement data.

By using SRQ, the controller can interface with the ME522A only when measurement data is output from the ME522A while the controller is controlling other equipment or processing data.

The ME522A can turn issuing of SRQ ON or OFF. Issuing of SRQ interlocks with automatic measurement data output as shown in Table 7-5.

Table 7-5 Measurement Automatic Data Output and SRQ Issuing ON/OFF.

	Automatic measurement data output	SRQ issue
When set to remote state	OFF	OFF
EGN	ON	ON
EGF	OFF	OFF

The contents of each bit of the status byte are as follows.

The controller uses the status byte to confirm that the SRQ has been issued or to detect the measurement data contents.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 6 --- SRQ

1: SRQ ON
0: SRQ OFF

Bits 4 and 0 --- Classification of measurement data

Bit 4	Bit 0	Data type
0	0	Measurement end data
0	1	
1	0	One second data
1	1	Alarm data

Bit 3 --- Measurement end data

1: Error detected.

0: No error detected.

Bit 1 --- Alarm data

1: At occurrence

0: At recovery

(Bits 7, 5 and 2 are not used.)

An example program is given below. In this example, all measurement data is fetched by the controller and displayed on the controller CRT. The ME522A receiver address is set to 2.

```
 10  DCL @102
 20  WAIT DELAY .5
 30  WRITE @102:"ETN,EPN,EGN,EEN"
 40  WRITE @102:"MST"
 50  PROCESS EVENT GPIB"@01,02"
 60  START GPIBSRQ
 70  CONNECT EVENT GPIB
 80  GO TO 80
 90  END
100  PARACT GPIBSRQ URGENCY 50
110    DIM A$*255
120    WAIT EVENT GPIB
130    STATUS @102:S
140    LET N=1
150    READ @102:A$
160    PRINT A$
170    IF BIT(4,S)=1 THEN 120
180    IF N=7 THEN 120
190    LET N=N+1
200    GO TO 150
210  END PARACT
```

This program is explained below.

Lines 10 and 20

DCL is used first to discard the old accumulated data. After DCL, insert a wait time of 0.5 seconds.

Line 30

Be careful because the measurement data is not output automatically and SRQ is not issued unless EGN is set.

Line 50 to 70

These commands define parallel processing.

Line 80

In this program example, the controller normally executed line 80. Thereafter, the program is executed from line 100 only when SRQ is received.

When other equipment is controlled or collected data is processed, the program is set here.

Lines 100 to 210

This program is for parallel processing.

Lines 110 and 150

The measurement data is read by the controller as a character string. When the character string is too long, the length is defined using a DIM command.

Lines 140 and 170 to 200

Since measurement end data is divided and output at several lines, these commands are required. Whether the data is measurement end data or not is determined on line 170 by bit 4 of the status byte.

The values of N on line 180 are as follows in accordance with the contents of the measurement end data (See Fig. 7-7).

- Ordinary data only: N = 3
- For ordinary data and threshold EI and EFI, or for ordinary data and error performance: N = 5

. For ordinary data, threshold EI and EFI, and error performance: N = 7

The commands on lines 140 and from lines 170 to 200 are not required when only the error rate and error count are output.

An output example of measurement data is given below.

1. Measurement end data

```
START MAY29/20:37:52END   MAY29/20:40:12ELAPSED  00/00:02:20*  MEASURED RESULT *
ERROR RATE   1.6E-02ERROR COUNT  1.5E09 ER INT(1.0s)      21 ER FREE INT 85.0000%
POWER FAIL         0sSIGNAL LOSS        4sSYNC LOSS          3sAIS SEC           0s
* THRESHOLD EI/EFI * ER      EI       EFI>E-3       7 95.0000%>E-4      10 92.8571%
>E-5      12 91.4285%>E-6      17 87.8571%>E-7      18 87.1428%<E-7       3 97.8571%
* ERROR PERFORMANCE*ES           14.7058%EFS          85.2941%SES (>E-3)    4.4117%
DM (>E-6)    44.1176%US            0.0000%
```

2. One second data

```
1.2E-05  29/20:31:02
```

3. Alarm data

```
MAY29/20:36:44       ,SYNC LOSS
MAY29/20:36:47       ,SYNC GAIN
```

(b) When SRQ is not used

An example program is given below.

The measurement data output format is the same as when SRQ is used.

SRQ is also issued in this example, but is ignored by the controller.

```
100  DCL @102
110  WAIT DELAY .5
120  WRITE @102:"ETN,EPN,EGN,EEN"
130  WRITE @102:"MST"
140  DIM A$*255
150  READ @102:A$
160  WRITE @117:A$
170  GO TO 150
180  END
```

(2) Output only when requested

The receiver enters this mode when it is set to remote state.

The data that can be output in this mode and control codes are as follows.

1. Measurement start data: GST
2. Intermediate data : GMO

The measurement data up to the time this code is received is output.

The one second data or alarm data is not output in this mode.

The program and output examples are given below.

(a) Measurement start data

Program example

```
100  DCL @102
110  WAIT DELAY .5
120  WRITE @102:"EGF MST"
130  WAIT DELAY 1
140  WRITE @102:"GST"
150  DIM A$*255
160  READ @102:A$
170  PRINT A$
180  END
```

This program is explained below.

Line 120

Always set EGF when measurement data is not automatically output.

Line 130

Issue GST one second after the measurement start command MST is issued.

Output example

```
START MAY29/19:54:35
```

(b) Intermediate

Program example

```
100  DCL @102
110  WAIT DELAY .5
120  WRITE @102:"MMU,EGF,MST"
130  WAIT DELAY 10
140  WRITE @102:"GMO"
150  DIM A$*255
160  READ @102:A$
170  PRINT A$
180  GO TO 160
190  END
```

Output example

```
START MAY29/20:35:36END    MAY29/20:35:56ELAPSED  00/00:00:20*  MEASURED RESULT *
ERROR RATE    1.2E-01ERROR COUNT   1.6E09 ER INT(1.0s)       3 ER FREE INT 85.0000%
POWER FAIL          0sSIGNAL LOSS         0sSYNC LOSS          3sAIS SEC            0s
```

SECTION 8

RS-232C (OPTION)

8.1 General

The ME522A RS-232C conforms to the Electric Industries Association (EIA) standards.

Except for the POWER switch and PANEL LOCK key, all panel keys of the ME522A can be controlled through the RS-232C interface.

The ME522A can also output the set panel contents or measurement data through the RS-232C interface.

The ME522A can use the RS-232C interface with the following optional numbers, which are all the same.

OPT 10: For ME522A Transmitter
OPT 11: For ME522A Receiver
OPT 12: For MH676A Multiplexer
OPT 13: For MH677A Demultiplexer

8.2 Functions

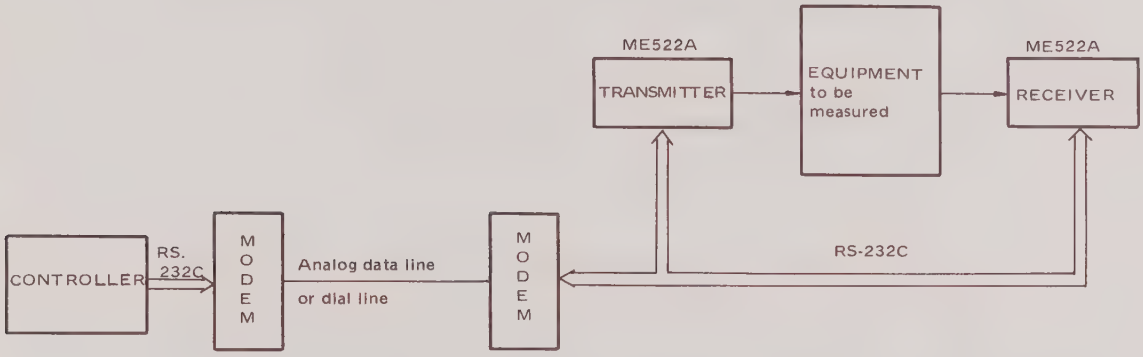
Table 8-1 Functions

Item	Remarks	Setting at shipment
Interface	Conforms to the EIA standards.	———
Communication formula	Full Duplex Nonsynchronous	———
Baud rate	50, 75, 110, 134.5, 150, 300 600, 1200, bps (Selectable by the Baud Rate switch on the rear panel.)	300 bps
Character length	7 bits, 8 bits (Selectable by the internal switch.)	7 bits
Parity	Odd, even, none (Selectable by the internal switch.)	Odd
Number of start bits	1 bit	———
Number of stop bits	1 bit, $1\frac{1}{2}$ bit, 2 bit (Selectable by the internal switch.)	1 bit
Settable items by RS-232C	All items on the front panel excluding th POWER switch and PANEL LOCK key.	———
Connector	DB-25P	———
Ambient temperature, rated range of use	0° to 50°C	———

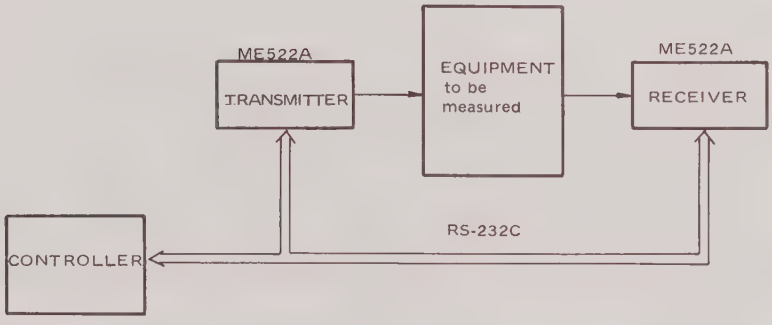
8.3 Preparations

8.3.1 Setup

Figure 8-1 is an example of the RS-232C interface setup.



(1) Setup of using a modem



(2) Setup of direct control from a controller

Fig. 8-1 RS-232C Interface Setup

8.3.2 RS-232C interface rear panel setting

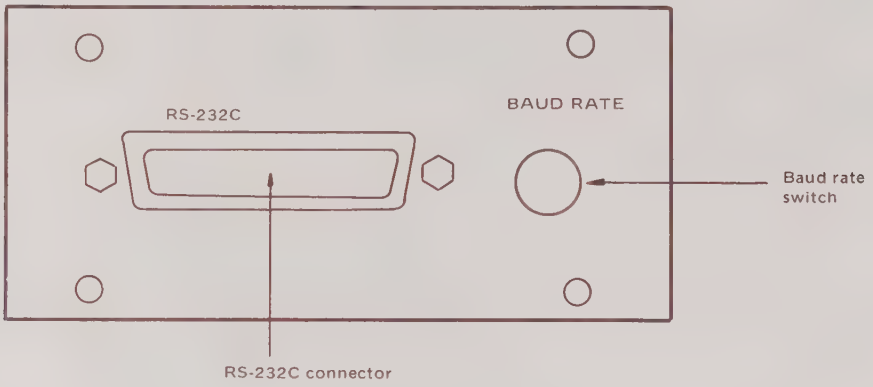


Fig. 8-2 RS-232C Rear Panel

Table 8-2 shows the correspondence between the numbers marked on the baud rate switch and baud rates.

Table 8-2 Correspondence Between the Numbers and Baud Rates

Number	0	1	2	3	4	5	6	7	8	9
Baud rate (bps)	50	75	110	134.5	150	300	600	1200	—	—

Note: Do not use numbers 8 and 9.

The BAUD RATE switch can be set to the required baud rate by turning the arrow mark in the switch to the number corresponding to it. In the example below, the arrow mark is set to 5.

The ME522A verifies the baud rate only when the power switch is turned ON. Therefore, for every time of changing the baud rate, the power switch of the ME522A must be turned OFF once, and then turned ON to be verified.

8.3.3 RS-232C interface internal switch setting

Figure 8-3 shows the location of the internal switch S2 and Fig. 8-4 shows the functions of the S2 switch bits.

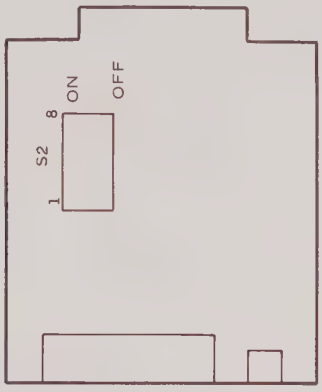
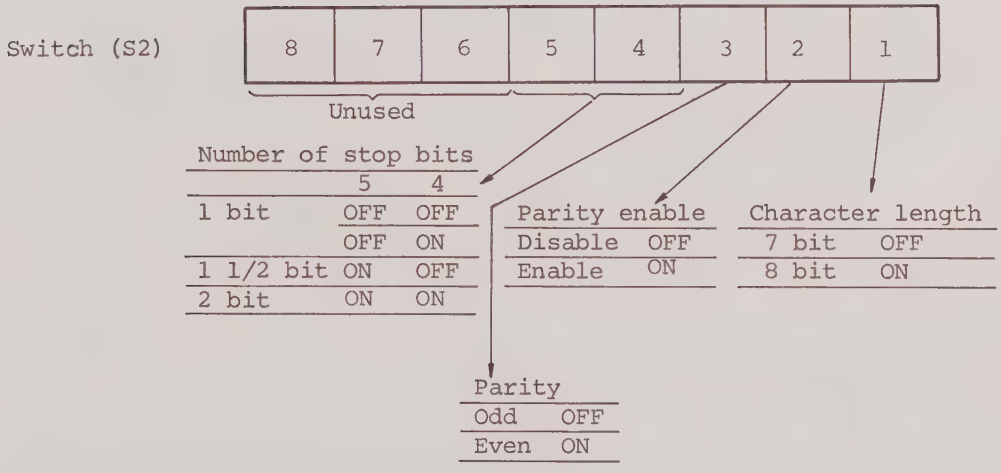


Fig. 8-3 Location of the Internal Switch



All the bits are OFF at shipment.

Fig. 8-4 Internal Switch S2

8.3.4 Controller setting

To operate the controller with the RS-232C interface, the baud rate and the parity set in the RS-232C interface must also be set in the controller.

In the following explanation, the ANRITSU Packet III is used as the controller.

The controller is set as follows.

```
SET @5: HVAL ("Set point")
     |                  |
   Select               |
   code                 |
                        |
                        See Figs. 8-5 and 8-6.
```

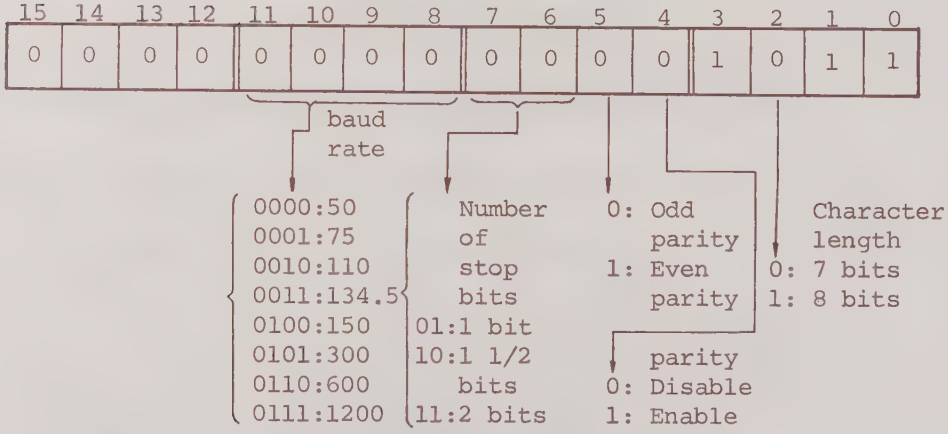
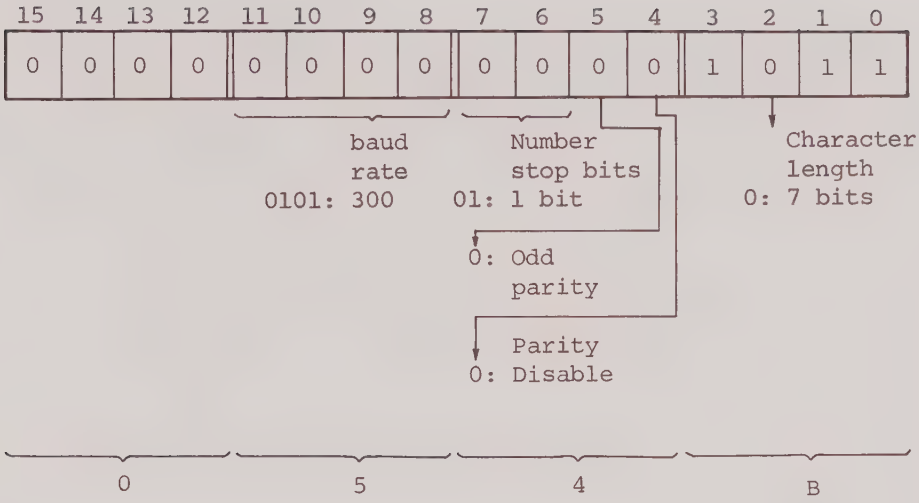


Fig. 8-5 Set Point of the RS-232C Interface

As an example, a setting is shown when each of the switch setting for the RS-232C interface of the ME522A is initiated.



SET @5: HVASL ("054B")

Fig. 8-6 Initial Set Point

8.4 Operation

8.4.1 ME522A panel setting

The panel is set as follows.

WRITE @5: "Control code"

See Tables 7-1 and 7-2 for the control codes.

8.4.2 ME522A panel setting read-out

A program example is given below.

```
10   DIM AS*255
20   WRITE @5: "DCL"
30   WAIT DELAY 0.5
40   WRITE @5: "EGF"
50   WRITE @5: "        "
                  ↑
              According to Tables 8-3 and 8-4
60   READ @5: A$
70   PRINT A$
80   GO TO 60
90   END
```

This program is explained below.

Line 20

The DCL code is used to discard the old data.

Note:

Lines 20 to 40 are not required for transmitter.

The output data is the same as that for the GP-IB interface. See paragraph 7.4.2.

Table 8-3 ME522A Transmitter Panel Setting Read-out Codes

Item	Code	Remarks
Key setting	GSW	
PROG A	GPA	
PROG B	GPB	
PROG C	GPC	
ALT D/E	GAL	
1/N	GIN	

Table 8-4 ME522A Receiver Panel Setting Read-out Codes

Item	Code	Remarks
Key setting	GSW	
PROG A	GPA	
PROG B	GPB	
PROG C	GPC	
1/N	GIN	

8.4.3 Fetching receiver measurement data

Like the GP-IB interface, automatic measurement data output by the RS-232C interface can be turned ON or OFF.

A program example is given below.

```
100  WRITE @5:"DCL"
110  WAIT DELAY .5
120  WRITE @5:"ETN,EPN,EGN,EEN"
130  WRITE @5:"MST"
140  DIM A$*255
150  READ @5:A$
160  PRINT A$
170  GO TO 150
180  END
```

The output data is the same as that for the GP-IB interface. See paragraph 7.4.3.

8.5 Exchanging the GP-IB and RS-232C Interfaces

Step	Procedure
1	Turn the transmitter (receiver) POWER switch OFF.
2	Remove the 4 screws #1 on the rear panel of the transmitter (receiver).
3	Attach a GP-IB plug to the GP-IB connector on the GP-IB interface PC board, and remove the PC board by pulling the GP-IB plug. To remove the RS-232C interface PC board, use the RS-232C plug in the same way as the GP-IB plug is used to remove the GP-IB interface PC board.
4	Insert the RS-232C interface PC board (or the GP-IB interface PC board) by aligning it with the guide rails.
5	Replace the 4 rear panel screws #1.

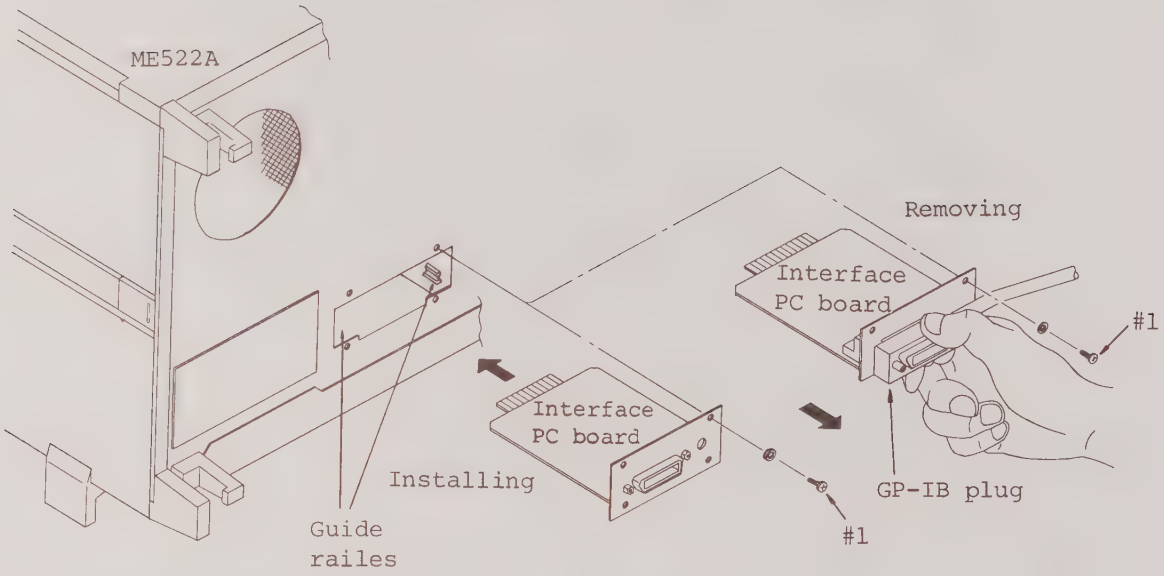


Fig. 8-7 Exchanging the Interface PC Boards

Anritsu Service and Sales Offices

America

Anritsu Wiltron Company
685 Jarvis Drive, Morgan Hill, CA
95037-2809, U.S.A
Phone: 408-776-8300
Fax: 408-776-1744

New Jersey Office
10 Kingsbridge Road Fairfield, NJ
07004, U.S.A
Phone: 201-227-8999
Fax: 201-575-0092

Anritsu Wiltron Eletronica Ltda.
Praia de Botafago 440, Sala 2401
CEP 22250-040, Rio de Janeiro, RJ,
Brazil
Phone: 021-286-9141
Fax: 021-537-1456

Anritsu Wiltron Instruments Ltd.
Unit 102, 215 Stafford Road Nepean,
Ontario K2H 9C1, Canada
Phone: 613-828-4090
Fax: 613-828-5400

Electronica 2000, S.A. de C.V.
Mexico, Mexico
Phone 05-662-8800/9989

Electronic Engineering S.A.
San Jos , Costa Rica
Phone: 2258793/2533759

HDM Elquitecnica Cia. Ltda.
Quito, Ecuador
Phone: 02-464587

Iota S.A.
Buenos Aires, Argentina
Phone: 01-432-8522/8459

Parker S.A.
Santiago, Chile
Phone: 02-231-9976/7147

Radiocom S.A.
Bogota, Colombia
Phone: 01-218-2054

Radiocomunicaciones cruz C.A.
Caracas, Venezuela
Phone: 02-7932322

Suministros Industriales, S.A.
Panama City, Panama
Phone: 64-2605, 69-2738

Vernal S.A.
Montevideo, Uruguay
Phone: 02-920171/920301

Europe

Anritsu Wiltron AB
Box 247, Jägerhorns väg 19, S-127
25 Skärholmen, Sweden
Phone: 08-7405840
Fax: 08-7404800

Anritsu Wiltron GmbH
Grafenberger Allee 54-56, D-40237 D
sseldofr 1, Germany
Phone: 0211-679760
Fax: 0211-683353

Anritsu Wiltron Ltd.
Capability Green, Luton, Bedfordshire
LU1 3LU, United Kingdom
Phone: 1582-418853
Fax: 1582-31303

Anritsu Wiltron S.A.
9, avenue du Québec ZAC de
Courtaboeuf 91951 LES ULIS
CEDEX, France
Phone: 01-64 46 65 46
Fax: 01-64 46 10 65

Anritsu Wiltron S.p.A.
Via Elio Vittorini, N.129, 00144 Roma
Eur, Italy
Phone: 06-5022666
Fax: 06-5022425

Anritsu Wiltron S.p.A. Milano Office
20041 Agrate Brianza (MI), C.D.
Colleoni, Via Paracelso 14, Italy
Phone: 039-639411
Fax: 039-639419

C.N. Rood B.V.
Rijswijk, Netherlands
Phone: 0-70-399-6360

C.N. Rood S.A./N.V.
Zellik, Belgium
Phone: 02-466-8199

Elsinco Bratislava s. r. o.
Bratislava, Slovakia
Phone: 0222-8121751

Elsinco Budapest KFT
Budapest, Hungary
Phone: 01-112-4854

Elsinco GmbH
Wien, Austria
Phone: 0222-8121751

Elsinco Polska Sp.z.o.o.
Warazawa, Poland
Phone: 022-396979

Elsinco Praha s. r. o.
Praha, Czecho
Phone: 02-4702 ex 451, 453

Elsinco Sofia
Sofia, Bulgaria
Phone: 02-581-698

G'Amundason H.F.
Reykjavik, Iceland
Phone: 01-687820

GMP S.A.
Lausanne, Switzerland
Phone: 021-6348181

Instrutek Periferi A/S
Horsens, Denmark
Phone: 75-611100

Into OY
Helsinki, Finland
Phone: 0-755-7711

Anritsu Service and Sales Offices

Kostas Karayannis S.A.
Athens, Greece
Phone: 01-323-0303/7731

Omnitecnica
Amadora, Portugal
Phone: 01-4715517

Teleinstrument AS
Asker, Norway
Phone: 66-901190

Unitronics, S.A.
Madrid, Spain
Phone: 91-542 52 04

Wien Schall GesmbH
Wien, Austria
Phone: 1-81155-140

Asia, Pacific and Africa

Alcatel Australia Ltd.
Sourth Melbourne, Australia
Phone: 03-694-6666
Alcatel Papua New Guinea Ltd.
Port Moresby, Papua New Guinea
Phone: 675-256933

Anritsu Wiltron (Singapore) Pte Ltd.
3 Shenton Way, #24-03, Singapore 106
Phone: 2265206
Fax: 2265207

Anritsu Wiltron Company Limited
Suite 812, 8/F., Chinachem Golden Plaza, 77 Mody Road, Tsim Sha Tsui East Kowloon,
Hong Kong
Phone: 2301-4980
Fax: 2301-3545

Associated Electric Trading Corp.
Lahore, Pakistan
Phone: 042-722-1716/7857

Beijing Liaison Office
Room No. 416, Beijing Fourtune Building 5 Dong San Huan Bei-lu, Chaoyang-qu Beijing 100004, China
Phone: 861-501-7551, 7552
Fax: 861-501-7553

Cha wei Electric Trading Co., Ltd.
Taipei, Taiwan
Phone: 02-561-2211

Chris Radiovision Ltd.
Nicosia, Cyprus
Phone: 02-466121

Etecsa CC
Midrand, South Africa
Phone: 11-315-1366

Giza Systems Engineering Co.
Cairo, Egypt
Phone: 02-3490140

Han-Il Commerce & Company
Seoul, Korea
Phone: 02-783-6391

Infotechs Ltd.
Colombo, Sri Lanka
Phone: 01-580088/500817

Inter Mühendislik Danismanlik ve Ticaret A.S.
Istanbul, Turkey
Phone: 216-349 9400

Meera Agencies (P) Ltd.
New Delhi, India
Phone: 685-3228/3959

Mercantile Information Telecommunication Technology Est.
Abu Dhabi, U.A.E.
Phone: 2-768909

National Projects and Technology Co. Llc
Wadi Kabir, Sultante of Oman
Phone: 791704

New Delhi Liasison Office
Room No. 508, Prakash Deep 7, Tolstoy Marg, New Delhi-110001, India
Phone: 011-3319133
Fax: 011-3713948

O'Connor's Engineering and Trading (Malaysia) Bhd
Selangor, Malaysia
Phone: 03-757-2828

O'Connor's Singapore Pte Ltd.
Singapore
Phone: 473-7944

Schmidt Telecom
Hong Kong
Phone: 507-0222

Scollay Holding Ltd.
Wellington, New Zealand
Phone: 04-4-722-961

P & P Telecom Co., Ltd.
Bangkok, Thailand
Phone: 02-271-2397/0057

P.T. Subur Sakti Putera
Jakarta, Indonesia
Phone: 021-3858361

Rajab & Silsilah & Co.
Jeddah, Saudi Arabia
Phone: 2-6610006

Salritsu International Trading Corporation
Metro Manila, Philippines
Phone: 632-8150946/8938998

Uto Trading Company
Seoul, Korea
Phone: 02-765-1800/1801

Japan

Head Office
5-10-27, Minamiazabu, Minato-ku, Tokyo 106
Phone: 03-3446-1111
Fax: 03-3442-0235

Atsugi Factory
1800, Onna, Atsugi-si, Kanagawa 243
Phone: 0462-23-1111
Fax: 0462-25-8379

Koriyama Factory
301, Dooba, Aza, Koriyama-shi, Fukushima 963
Phone: 0249-56-2112
Fax: 0249-56-2299

Osaka (Anritsu Technics)
1-10-31, Mikunihonmachi, Yodogawa-ku, Osaka 532
Phone: 06-391-0697
Fax: 06-391-1748

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